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RESEARCH REPORTS

December 16, 1960
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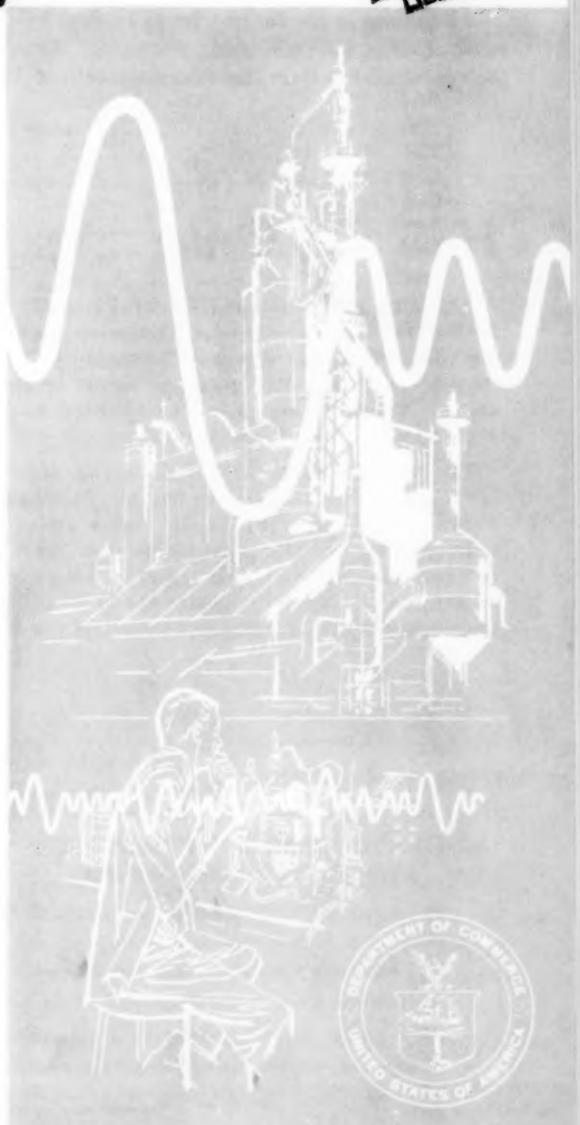

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Limitations for nighttime detection of celestial bodies employing the image orthicon and the intensifier image orthicon. June 60. 46p. (PB 161 951) $1.25 673

BEHAVIORAL SCIENCES

Device and tests for measuring intellectual functions during acceleration. May 60. 39p. (PB 171 019) $1.25 680

Human performance as a function of the work-rest cycle. Mar 60. 21p. (PB 161 958) 75 cents 680

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Closed circuit respiratory systems symposium. Aug 60. 470p. (PB 161 988) $6.00 683

Design parameters for the engineering of closed respiratory systems. Dec 59. 18p. (PB 161 963) 50 cents 681

Determination of internally deposited radioactive isotopes in the Marshallese people by excretion analysis. 1960. 19p. (PB 161 950) 50 cents 688

Radiological health data. Volume I, No. 6. Sep 60. 61p. (PB 161 371-6) 50 cents, $3.00/6 mos 687

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Photochemical process for preparation of master terrain models. Aug 60. 13p. (PB 161 993) 50 cents 698

Upper wind statistics charts of the northern hemisphere (850, 700 and 500 mb levels). Aug 59. 94p. (PB 161 995-1) $35.00 695

Upper wind statistics charts of the northern hemisphere (300, 200 and 100 mb levels). Aug 59. 97p. (PB 161 995-2) $35.00 695

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Mark I perceptron operators' manual. Feb 60. 62p. (PB 161 997) $1.75 797
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Microfilm index. 1946. 770p. (PB 161 976) $8.00 ($10.00 foreign) 799

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Vol. 34, No. 6 Pages 673 - 816 December 16, 196

AGRICULTURE

Plant Cultivation

Wisconsin U., Madison.
COASTAL PIONEER PLANTS OF THE CARIBBEAN AND GULF OF MEXICO, by Jonathan D. Sauer. Final rept. on Contract Nonr-1202(08). 12 Oct 59, 92p. 212 refs. AD-228 002.
Order from LC mi$5.40, ph$15.30 PB 149 860

Contents:
Sites studied and species encountered
The coastal flora in general
Inland vs. littoral species
Primarily inland species
Ambivalent species
Primarily littoral species
Plant dispersal by ocean currents
Primarily littoral species
Ambivalent and inland species
The flora of different shore types
Salt flats, marsh and estuary margins
Artificial shores
Natural sand, gravel, and limestone shores
Microdistribution patterns
Irregularities unrelated to habitat
Zonation parallel to the shore

Naval Photographic Interpretation Center, Washington, D. C.
AERIAL PHOTOGRAPHIC INTERPRETATION OF DISEASED AND HEALTHY CEREAL CROPS, by L. W. Keith. 30 Jan 53, 13p. PIC rept. 102-53.
Order from LC mi$2.40, ph$3.30 PB 150 785

This report released for sale to the public 11 Oct 60.

ASTRONOMY

Aeronautical Research Labs., Air Force Research Div., Wright-Patterson AFB, Ohio.
THE LIMITATIONS FOR NIGHTTIME DETECTION OF CELESTIAL BODIES EMPLOYING THE IMAGE ORTHICON AND THE INTENSIFIER IMAGE ORTHICON, by Radames K. H. Gebel. Rept. on Research on the Quantum Nature of Light. June 60, 46p. 9 refs. WADC Technical note 59-131.
Order from OTS $1.25 PB 161 951

This paper concludes that it is theoretically possible, by using the intensifier image orthicon, to exceed by ten magnitudes the faintest star ever recorded. Generally, the final limit of detectability of faint stars is determined by the randomness in the radiation of the sky background. Further limitations are imposed by the statistical fluctuations in the conversion of photons into electrons at the photocathode and the statistical fluctuations of the photocathode dark current emission. When using the image orthicon without intensifiers, these fluctuations become small with respect to the scanning beam fluctuations. Part I deals with the conventional image orthicon, with the scanning beam fluctuations usually being the prime factor in limiting detectability. An equation is derived which permits calculation of the apparent star magnitude which can be recorded under the made assumption with the image orthicon without intensifier stages. Part II deals mainly with the intensifier image orthicon. Formulas are derived for the intensifier image orthicon for threshold star magnitude number, as determined by the fluctuations in the emission due to sky radiation and photocathode dark current emission. (Author)

Astrophysics

Astrophysical Observatory, Smithsonian Institution, Cambridge, Mass.
STUDY OF ATMOSPHERIC ENTRY AND IMPACT OF HIGH VELOCITY METEORITES, by Fred L. Whipple. Quarterly status rept. no. 18, 1 Apr-30 June 60, on Contract AF 18(600)1596. 31 Aug 60, 5p.
Order from LC mi$1.80, ph$1.80 PB 150 382

See also PB 148 019

Brandeis U., Waltham, Mass.
ELECTRON SCREENING IN DENSE DEGENERATE GASES, by Jack S. Goldstein. Final rept. on Contract AF 19(604)5563. 30 May 60, 24p. 12 refs. AFCRC-TR-60-275.
Order from LC mi$2.70, ph$4.80 PB 149 596

An investigation is made of the screening properties of a degenerate electron gas, with principal attention placed on the physical conditions to be found in white dwarf stars. In particular, the effect on nuclear reaction rates is considered. We find that although the method of approach differs, the result is not significantly different from that obtained by previous authors except in a very narrow range of densities. (Author)

California U., Los Angeles.
THE "ASTRONOMICAL UNIT" AND THE SOLAR PARALLAX, by Samuel Herrick, George Westrom, and Maud W. Makemson. Rept. on Contract AF 49(638)498. 30 Sep 59, 26p. 24 refs. Astrodynamical rept. no. 5; AFOSR-TN-59-1044; AD-234 711.
Order from LC mi$2.70, ph$4.80 PB 148 266

A plan for the exploration of the world of planets has developed divergencies of usage on the navigation of interplanetary vehicles, of which one of the most significant and interesting concerns the unit of distance and associated trajectory constants. On the one hand there are those, steeped in laboratory concepts and units and in thrust and drag, who prefer to bring the planets into line by expressing their coordinates in laboratory units. On the other hand there are those who point out that the positions of the planets and the gravitational constant have accuracies up to 8 or 9 significant figures when the unit of distance is the astronomical unit (approximately the mean distance of the earth from the sun) and only to 3 or 4 in any laboratory unit. The pros and cons of these 2 schools of thought, and the 2 ways of handling the trajectory calculations, are explored in connection with specific orbit problems. (Author)

Free U. of Berlin (Germany).
REMARKS ON THE VALIDITY OF A TEST FOR EVOLUTION, by K. Just and R. Wielen. Technical note no. 1 on Contract AF 61(052)335. 3 May 60, 9p. 4 refs. AFOSR-TN-60-916.
Order from LC mi$1.80, ph$1.80 PB 150 348

The former test against a steady state of the universe (Just: Ap. J. 129 (1959) 268-270) holds even when the used clusters of galaxies are catalogued (Abell: Ap. J. Suppl. 3 (1958) 211 - 288) with certain systematic errors. (Author)

Harvard Coll. Observatory, Cambridge, Mass.
EVAPOROGRAPHY WITH SPECIAL APPLICATION TO THE MOON, by Hector C. Ingrao and Donald H. Menzel. Scientific rept. no. 4 on Contract AF 19(604)3074. 15 June 60, 44p. 31 refs. AFCRC-TN-60-469.
Order from LC mi$3.30, ph$7.80 PB 149 806

The methods of evaporography and condensography are discussed with special application to the Moon. Measurements of the droplets, resolving power and detectivity are given. On July 30, 1958, a condensograph of the Moon was obtained with integrated radiation and an evaporograph through a germanium filter; both photographs were made with a reflector of 8-inch aperature and effective focal ratio F/1.85. The feasibility of this technique for a study of some properties of the surface of the Moon is discussed. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
EXTRATERRESTRIAL RADIATION OF NONTHERMAL ORIGIN, by S. Kownacki. Technical note on Physical Electronics. June 60, 31p. 27 refs. LMSD-703032.
Order from LC mi$3.00, ph$6.30 PB 149 594

A type of radiation where spectral energy distribution does not conform with Planck's radiation law is discussed. Various possible mechanisms of its generation are considered with particular emphasis on the "synchrotron mechanism," radiation of electromagnetic waves from fast, charged particles subjected to the centripetal acceleration by magnetic fields. An analysis of the more convincing aspects of the theory as well as its inadequacies is given with description of relevant experimental evidence. The need for further experimental and theoretical work in connection with both the synchrotron mechanism and other alternatives is presented. In particular, additional work is discussed in some detail as related to the investigation of the spectral distribution of radiation, polarization, evaluation of magnetic fields, and to the number and energies of radiating particles. Finally, possible fields of inquiry are mentioned as well as methods of approach to the problems of developing models of alternative mechanisms. (Author)

Maryland U., College Park.
DISTRIBUTION OF DENSITY IN A PLANETARY EXOSPHERE, PART II, by E. J. Opik and S. F. Singer. Rept. on Contract AF 19(604)3861. 20 June 60, 28p. 6 refs. GRD-TN-60-606.
Order from LC mi$2.70, ph$4.80 PB 149 952

In an isolated neutral exosphere three components are distinguished: (1) elliptic-ballistic; (2) hyperbolic-ballistic; (3) bound-elliptic. Component (2) forms the escape flux which cannot be defined simply. Numerical results are given for neutral hydrogen and oxygen, applicable to the terrestrial exosphere. (See also PB 142 711)

Maryland U., College Park.
SOME CONSIDERATIONS OF EXPECTED RADIATION BELTS OF PLANETS MARS AND VENUS, by S. F. Singer. Scientific rept. no. 4 on Contract AF 19(604)5575. Jan 60, 23p. 50 refs. ERD-TN-60-573.
Order from LC mi$2.70, ph$4.80 PB 149 887

The historical development of the ideas which led to the prediction of geomagnetically trapped radiation are briefly traced out. Direct observations are then summarized, and various theories concerning the origin of the radiation belts are discussed. The neutron albedo-plus-solar injection theory (which predicts existence of two belts) is then applied to calculate the expected distribution of trapped particles near Mars and Venus. The "sweeping" effect of the Martian satellite Phobos is calculated; it should provide a radiation-free base near Mars. (Author)

Maryland U., College Park.
STRUCTURE OF THE EARTH'S EXOSPHERE, by S. F. Singer. Rept. on Contract AF 19(604)3861. 27 June 60, 10p. 10 refs. GRD-TN-60-607.
Order from LC mi$1.80, ph$1.80 PB 149 953

The main components of the earth's exosphere are neutral oxygen, neutral hydrogen atoms, ionized oxygen. The position of the base of the exosphere is established at an altitude of 530 km from an analysis of density data obtained from satellite drag observations. The relative distribution of both neutral oxygen and neutral hydrogen is derived from a theory of the exosphere. The normalization of oxygen is accomplished by means of satellite drag data. The normalization of hydrogen is accomplished by the use of the Lyman-alpha technique of Johnson, Friedman and Tousey. The distribution of ionized oxygen can be established jointly from the rocket measurements of Berning and from an analysis of radiation belt data obtained from satellites. They give a consistent picture of ionized oxygen becoming the most important constituent of the atmosphere at about 1500 km. The distribution of ionized hydrogen is only imperfectly known at the present time. (Author).

Oklahoma State U. Research Foundation, Stillwater.
AN ANALYSIS OF ROCKET AND EARTH SATELLITE MEASUREMENTS OF MICROMETEORIC INFLUX, by Curtis W. McCracken. Master's thesis. Final rept. vol. II, appendix B on Acoustic Detection of Meteoric Particles, Contract AF 19(604)1908. 14 Apr 60, 128p. 52 refs. AFCRC TR-60-272, vol. 2, app. B; AD-240 260.
Order from LC mi$6.30, ph$19.80 PB 150 381

The micrometeor data and some of the other available data on meteoric influx are plotted together as particle influx versus particle momentum to get a tentatively revised mass distribution curve. An equation is fitted to the tentatively revised mass distribution curve in order to obtain the corresponding tentatively revised mass distribution function. The new mass distribution function allows a significant extension of the known mass distribution function for meteoric particles. Some of the implications of the tentatively revised mass distribution function are discussed in a quite qualitative manner. (Author) (See also PB 149 099)

Palomar Observatory, San Diego, Calif.
A THEORY OF THE ROLE OF MAGNETIC ACTIVITY DURING STAR FORMATION, by Evry Schatzman. Special technical rept. no. 3 (Pre-print) on Contract AF 49(638)21. 14 Jan 60, 27p. 14 refs. AFOSR-TN-60-214; AD-234 150.
Order from LC mi$2.40, ph$3.30 PB 147 618

BEHAVIORAL SCIENCES

Human Engineering

Aeronautical Instruments Lab., Naval Air Development Center, Johnsville, Pa.
EXPERIMENTAL DESIGN FOR HUMAN ENGINEERING EVALUATION OF DV-10/A2F DISPLAYS, by William A. Bradley. Rept. on Proj. TED ADC AV-73011. 30 June 59, 21p. Rept. no. NADC-AI-5958.
Order from LC mi$2.70, ph$4.80 PB 149 526

The purpose of this experiment is to determine the optimum scale factors of certain variables in an electronic contact analog display on the basis of minimum errors obtained in this experiment. These optimum scale factors will then be utilized in the experimental cockpit of the R4Y in real flight and the results compared with those obtained in the simulator.

California U., Los Angeles.
STUDIES OF EFFECTIVENESS OF ELIMINATION OF DISPLAYED INFORMATION WITH OBSERVER PRACTICE INCREASE. Annual summary rept. for Nov 58-Sep 59 on Contract Nonr-233(49). Oct 59, 28p. Dept. of Engineering rept. 58-62; AD-229 418.
Order from LC mi$2.70, ph$4.80 PB 149 507

A review of research accomplishments during the year 1958-1959 is presented. Activities fell into broad categories as follows: (1) development and check-out of an electronically controlled display and control panel and necessary recording apparatus for the study of specified display variables in a perceptual-motor task; (2) development of methodology and actual construction of a versatile paper-and-pencil test for the evaluation of redundancy in dial reading tasks; and (3) initial experimental investigations and subsequent statistical analyses for the evaluation of probability distribution and the performance effects of additional signal cues on the apparatus task, and the evaluation of performance effects as a function of both type and amount of redundancy on a simulated dial reading task. (Author)

Control Systems Lab., U. of Illinois, Urbana.
HUMAN PERFORMANCE IN INFORMATION TRANSMISSION. PART VI. EVIDENCES OF PERIODICITY IN INFORMATION PROCESSING, by L. G. Augenstine. Rept. on Contract DA 36-039-sc-56695. Dec 58, 38p. 7 refs. Rept. R-75; AD-209 278.
Order from LC mi$3.00, ph$6.30 PB 149 398

In the present study an attempt has been made to specify some of the properties associated with data processing.

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
TRANSFER OF TRAINING AMONG COMPONENTS OF A COMPLEX VELOCITY CONTROL TASK, by Randall M. Chambers. Rept. no. 3 on BuMed Proj. MR 005.15-1003.1. 28 Dec 59, 24p. 12 refs. NADC-MA-5920; AD-233 756.
Order from LC mi$2.70, ph$4.80 PB 148 273

The principle of transfer of training among task components states that practice on one part within a total task will result in increments in performance proficiency on the other parts as well as in the total task, provided that the parts are similar to one another. Results of tests conducted on 9 groups of airmen who were given specific practice on parts of a complex multidimensional compensatory rate control task showed that skill proficiency on certain unpracticed components within the total-skill complex was changed as a function of practice on certain components. Practice on the originally difficult component singly, and practice on this component simultaneously with other components, resulted in major reorganization of the skill complex, and in significant increments in total task performance over that of controls, whereas practice on the originally easiest component or combinations involving the easiest component, were generally less effective, even though marked transfer of training occurred. More transfer of training to the total-task occurred following practice on the originally difficult component and/or combinations involving it than following practice on the originally easy component and/or its combinations. Within the task, transfer of training was more effective than the practice itself for raising the proficiency level of originally easy components. However, in situations involving originally difficult components, transfer of training was slightly less effective than practice itself for raising the proficiency level of that component. (Author)

Educational Research Corp., Cambridge, Mass.
A TRAINING ANALYSIS OF THE PILOT'S TASK IN TRANSITIONING TO JET VTOL AIRCRAFT, by Phillip J. Rulon and Milton W. Horowitz. Rept. on Contract N61339-74. Sep 59, 57p. 6 refs. Technical rept. NAVTRADEVCEN 74-1; AD-231 477.
Order from LC mi$3.60, ph$9.30 PB 148 271

An analysis of Vertical Take-off and Landing (VTOL) flight training problems was undertaken. The study consisted primarily of discussions with technical and pilot personnel, examination of test flight reports, and observation of VTOL aircraft from the human engineering viewpoint. Since VTOL aircraft were still in the development stage, the study was necessarily anticipatory and opportunistic. However, an attempt was made to provide data most relevant to horizontal attitude VTOL. A number of factors were found to make the task of flying VTOL aircraft exceptionally difficult. The more important of these were: (1) need for great precision in controlling aircraft, especially during transition from the hovering to the aerodynamic mode; (2) poor visibility from the cockpit during certain flight modes; (3) variations in display-control relationships and instrument responsiveness and sensitivity as a function of flight mode; and (4) inadequate instrumentation for determining whether aircraft is sustained by thrust or aerodynamic control. Solutions of these problems are considered in terms of better instrumented and human engineering VTOL aircraft; previous helicopter training; the use of 2-place VTOL training aircraft; and selected training devices. (Author)

Human Resources Research Office, George Washington U., Washington, D. C.
LEADERSHIP IN ARMY INFANTRY PLATOONS: STUDY II, by Carl J. Lange and T. O. Jacobs. Rept. on Contract DA 49-106-qm-1. July 60, 42p. 4 refs. Research rept. 5.
Order from LC mi$3.30, ph$7.80 PB 149 966

A Leader Activities Questionnaire (LAQ) was developed to measure leader behavior variables found in an earlier study to be associated with judgments of leader effectiveness. The LAQ was planned for use as a measure of the effectiveness of experimental platoon leader training based on the leader behavior variables identified earlier. Results of the tryout indicated that most of the LAQ scoring categories were satisfactory as to internal consistencies and the extent to which platoon members agreed in describing behavior of their platoon leaders. Validities of parallel variables from the earlier and the present study were in substantial agreement. This was interpreted as evidence that the LAQ measured acceptably well those variables it was designed to measure. The close agreement between the two sets of results increases the confidence with which the findings of the earlier study can be used as a basis for training platoon leaders. (Author) (See also PB 142 579)

Illinois U., Urbana.
PART- VERSUS WHOLE-TASK LEARNING OF A FLIGHT MANEUVER, by Jack A. Adams, Lyle E. Hufford, and James M. Dunlop. Rept. on Contract N61339-297. 21 June 60, 58p. 13 refs. Technical rept. NAVTRADEVCEN-297-1.
Order from LC mi$3.60, ph$9.30 PB 150 180

Two matched groups of pilots were trained in a hypothetical toss-bomb maneuver to be performed in the SNJ Operational Flight Trainer. One group had separate training in flight control and procedural tasks; the contrasted group had concurrent training in the two classes of tasks. After equal amounts of training, both groups were asked to perform the maneuver in the whole-task version (i.e. criterion task). Analysis of the whole-task performance of the two contrasted groups revealed that only on the first trial was the part-task group less proficient than the group that learned the two types of tasks concurrently. And even then, this inferiority was shown only on the procedural aspects of the whole task. As for the flight control tasks, they were performed equally well by both groups on the very first whole-task trial.

Naval Personnel Research Field Activity, Washington D. C.
COMPARISON OF PERFORMANCE AND UTILIZATION OF FTs WITH DIFFERENT TRAINING AND ASSIGNMENT BACKGROUNDS, by Norman Labbe and Bert T. King. Mar 60, 27p. 3 refs. Technical Bulletin 60-2.
Order from LC mi$2.70, ph$4.80 PB 150 007

Data were collected aboard ships of the Atlantic Fleet dealing with the reenlistment intentions, professional and technical performance, and shipboard training and utilization of 265 Fire Control Technicians (FT). It was found that: (1) The incidence of reenlistment intentions was not associated with pay-grade level, GCT+ARI score, "A"-School attendance, or size of FT complement. (2) Better professional and military performance were associated with "A"-School attendance, petty-officer status, and higher GCT+ARI scores. (3) Speed of advancement was related to "A"-School attendance but not to GCT+ARI or size of FT complement. (4) Assignment to more difficult equipments was more frequent for men in larger complements. However, assignment to more difficult tasks characterized men in smaller complements, petty officers, and graduates of Class "A" FT School. (5) About one-half of these technicians were considered by their supervisors to have critical training needs.

Naval Personnel Research Field Activity, Washington, D. C.
SPEED FACTORS IN OFFICER SELECTION MEASURES, by Leonard Wollack and Isaiah Guttman. Feb 60, 31p. 18 refs. Technical Bulletin 60-5.
Order from LC mi$3.00, ph$6.30 PB 150 191

This research sought to find out if certain speed factors could account for the improvement that had been obtained in the prediction of success at Officer Candidate School when the experimental Verbal-Numerical Test (VNT) was used along with the operational Officer Qualification Test (OQT). The analyses offered no support to the hypothesis that "speed" accounted for the unique covariance in question. Rather, it appeared that quantitative reasoning components of the VNT best explained the improvement in prediction. Consequently, in the development of new forms (7, 8, and 9) of the OQT a greater number and variety of mathematics items are being included. (Author)

New York U., N. Y.
AUTOMATED TEACHING: A REVIEW OF THEORY AND RESEARCH, by Robert E. Silverman. Rept. on Contract N61339-507. 8 June 60, 49p. 56 refs. Technical rept. NAVTRADEVCEN-507-2.
Order from LC mi$3.30, ph$7.80 PB 150 179

The present state of research in the area of automated teaching and the application of automated teaching devices were reviewed in terms of issues relating to programming, to machine variables, and to studies comparing conventional instruction with automated instruction. Some basic issues were singled out for consideration. Such problems as prompting, confirmation, reinforcement, size-of-step, and branching were considered. The design and construction of machines were judged to be a secondary issue; the question of programming takes precedence. The problem of measuring the effects of automated teaching was considered to be crucial, since it is bound to the question of what is to be learned. It was also pointed out that job analyses of learning tasks must be done and measurement problems solved before valid comparisons between automated and conventional instruction can be made. (Author) (See also PB 148 755)

Pennsylvania State U., University Park.
THE EFFECTIVENESS, ACCEPTABILITY, AND FEASIBILITY OF TECHNICAL TRAINING COURSES RECORDED ON SOUND MOTION PICTURES AND SLIDES PLUS TAPES, by D. P. Duvall, L. P. Greenhill and others. Rept. on Contract N61339-364. June 60, 26p. Technical rept. NAVTRADEVCEN-364-1.
Order from LC mi$2.70, ph$4.80 PB 150 178

The purpose of this study was to develop and evaluate economical and effective means for recording existing courses of instruction in technical areas for subsequent use on shore or in the fleet. The techniques for attempting to do this included the use of minimum cost sound motion pictures, and 2" x 2" slides with audio tape. Specifically, comparisons were to be made between: (a) instruction recorded on 16mm sound motion pictures and face-to-face instruction, and (b) instruction recorded on 2" x 2" slides plus audio tape and face-to-face instruction. The comparisons were to be in terms of (1) the relative effectiveness of the methods as measured by the performance of trainees following the courses, (2) the acceptability of the methods, and (3) the feasibility of the methods. (Author)

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.
A REGRESSION ANALYSIS OF ONE SET OF AIRMAN PROFICIENCY TEST SCORES, by Chester J. Judy. June 60, 14p. 7 refs. WADD-TN-60-139.
Order from LC mi$2.40, ph$3.30 PB 150 076

One criterion for airman skill upgrading in the Air Force is met by attaining a qualifying score on an applicable Airman Proficiency Test (APT). This note reports an analysis which shows the proportion of variance one such test has in common with selected measures of training, experience, education, aptitude, supervisory opinion, and airman attitudes for a sample of 384 aircraft mechanics tested in 1956 and 1957. Each of these categories of information, excepting airman attitudes, could be used to predict the APT criterion at some level of effectiveness; but only the training variables and the aptitude variables added significantly to the prediction attainable by using all other available information. Other research was cited in which various APT correlates are reported. Results show the utility of APT scores in defining one important aspect of airman proficiency. (Author)

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.

CHARACTERISTICS OF OFFICERS GRADUATING IN 1954 FROM AIR FORCE INSTITUTE OF TECHNOLOGY PROGRAMS, by David K. Trites and Robert N. Cyzmoure. Apr 60, 40p. WADD TN-60-46; AD-237 212.
Order from LC mi$3.00, ph$6.30 PB 148 246

The results of a survey of 360 officers who remained in the Air Force and of 151 officers who left the Air Force subsequent to graduation from training programs sponsored by the Air Force Institute of Technology are reported. Background information was collected and questionnaires were mailed to each group of officers. It was found that officers remaining on active duty are generally older, have more rank, have spent more time in service, and more frequently are rated than were officers leaving service. A number of possible methods of improving retainability are identified and discussed. The most important of these are: (1) require a period of active duty service prior to assignment to AFIT programs; (2) increase the length of obligated service following AFIT graduation; (3) following AFIT graduation, insure that officers have sufficient time and opportunity to meet requirements for continued flying status; (4) in no way jeopardize an officer's promotion list status as a result of AFIT training; (5) continue to offer Distinguished Military Graduates of AFROTC regular commissions upon entering active duty in the Air Force; (6) increase the length of assignments following AFIT graduation; and (7) provide proficiency pay to reduce the gap between Air Force and civilian salaries for the same jobs. (Author)

Personnel Lab., Wright Air Development [Div.] Lackland AFB, Tex.

CONSTRUCTION AND VALIDATION OF THE INSTRUCTOR APTITUDE TEST, by Cecil J. Mullins and John A. Cox. Dec 59, 9p. 2 refs. WADC TN-59-203; AD-230 968.
Order from LC mi$1.80, ph$1.80 PB 150 590

This report released for sale to the public 11 Oct 60.

A test was constructed for predicting success in Technical Instructor Schools, using items previously proved valid for General Instructor School success and for Pilot Instructor School success. It consists of four parts: a verbal section, an arithmetic reasoning section, a social insight section, and an interest section. The test was normed for instructors now performing on the job. Validation coefficients were obtained between test scores and course grades in Technical Instructor Schools at six Air Force bases. Validities ranged from .06 to .63, with five of the six highly significant. These compare favorably with validities of the General Aptitude Index of the Airman Classification Battery for the final school grade criterion. Test scores identified eliminees from Technical Instructor Schools with considerable accuracy.

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.

CONVERSION OF APTITUDE INDEXES BETWEEN FORMS AC-1B AND AC-2A OF THE AIRMAN CLASSIFICATION BATTERY, by Bart B. Cobb. Feb 60, 9p. 4 refs. WADD TN-60-39; AD-237 210.
Order from LC mi$1.80, ph$1.80 PB 148 245

This study represents an empirical approach by which scales have been developed to facilitate conversion of aptitude indexes derived from the Airman Classification Battery AC-1B to equivalents of corresponding aptitude indexes for the Airman Classification Battery AC-2A. There has been a continuing need, both in test development and in operational situations, for a reliable means of converting the stanine-type aptitude indexes to the modified percentile-type indexes of Battery AC-2A. The Armed Forces Qualification Test score was used as a reference variable to select and equate an AC-1B sample. Frequency distributions were obtained for each of four sets of corresponding indexes and conversion tables were derived by the equipercentile technique. These tables are appropriate for use when comparing qualifications of individuals tested by different forms of the Airman Classification Battery. (Author)

Personnel Lab., Wright Air Development Div., Lackland AFB, Tex.

IMPACT OF A NEGATIVELY WEIGHTED VARIABLE ON THE VALIDITY OF AN APTITUDE INDEX, by Leland D. Brokaw and Helen Tomlinson. Jan 60, 8p. 4 refs. WADD TN-60-38; AD-237 209.
Order from LC mi$1.80, ph$1.80 PB 148 244

Evaluation of the impact of a negatively weighted variable as a part of a composite score is made by comparison between the characteristics of such composites and the characteristics of the composites with that variable removed. The validity of the aptitude indexes was increased, but not significantly, by eliminating the negatively weighted element; the correlation between the aptitude indexes was strongly affected. The aptitude indexes, containing the negatively weighted elements, were not appreciable correlated with each other; but the composites, within the negatively weighted elements, were positively intercorrelated. The results strongly support the use of negatively weighted elements in the aptitude indexes of differential classification batteries; they indicate that other purposes are best served by batteries involving only positively weighted elements. This conclusion is pertinent only to aptitude composite whose components all have positive validity. (Author)

Personnel Research and Development Corp., Cleveland, Ohio.

SPATIAL TESTS AS PREDICTORS OF SUCCESS IN AIR FORCE TRAINING, by Erwin W. Taylor and James W. Parker. Rept. on Contract AF 41(657)125. Dec 59, 43p. 2 refs. WADC TR 59-361.
Order from LC mi$3.30, ph$7.80 PB 149 625

The Airman Classification Battery includes two measures of spatial ability. In a search for possible improvement of coverage, 20 spatial tests were investigated to determine their validity for predicting success in Air Force training courses in five career fields representing the five aptitude indexes used in airman classification and assignment. Factor analysis indicated that a heterogeneous test was a better measure of spatial ability than were tests composed of homogeneous items. Of the final school grades as criteria, those for Aircraft Mechanic were most predictable both from Airman Classification Battery tests and from the spatial tests. Those for Organizational Supply Specialist were least predictable. Of the spatial battery tests, the most promising for a place in a differential classification battery is the heterogeneous subtest, Space Survey I. This had high individual validity for mechanical training but generally lower validity for other training. The authors suggest, as a general predictor of success in technical school, a composite which would include measures of academic ability, verbal facility, and ability to handle abstractions. (Author)

Psychology

Air Force Command and Control Development Div., Bedford, Mass.
A SIMULATION FACILITY FOR THE EXPERIMENTAL STUDY OF DECISION MAKING IN COMPLEX MILITARY SYSTEMS, by Joseph M. Doughty. July 60, 27p. 1 ref. AFCCDD-TN-60-32.
Order from LC mi$2.70, ph$4.80 PB 149 979

A system simulation facility and methodology for the study of human decision-making in military air surveillance systems is described. Contemplated experimental studies of decision-making at various levels of command and in various functions is outlined. Results of preliminary development of procedures and measures of performance are given. (Author)

Harvard Graduate School of Education, Cambridge, Mass.
TALK ABOUT SELF: THE RESULTS OF A PILOT SERIES OF INTERVIEWS IN RELATION TO GINZBERG'S THEORY OF OCCUPATIONAL CHOICE, by Robert P. O'Hara (Boston Coll.) Rept. no. 14 on Harvard Studies in Career Development, and Technical rept. no. 10 on Contract Nonr-1866(31). Oct 59, 17p. 2 refs. AD-227 532.
Order from LC mi$2.40, ph$3.30 PB 149 854

The nature of evolving conceptions of self was explored. Fifteen boys in the first, third, fifth, seventh, and ninth grades were interviewed. A boy of high, average, and relatively low intelligence was chosen for each level. The interview covered the following areas: (1) what sort of boy are you; (2) things you like to do; (3) present occupational choice and reasons for it; (4) past choices and reasons for changing them; and (5) role models. Results indicated a predominance of relatives as role models. The boys considered themselves as objective entities and began to evaluate themselves as early as the first grade. Reality testing, objective appraisal, entered the career development earlier than Ginzberg and his associates (An Approach to a General Theory, Columbia University Press, N. Y. 1951) suggested. Evidence of the need for compromise appeared to occur by the age of 12 and 13. A rational connection was indicated between the choices and the bases for choice during the fantasy period. Rejection of the former choices also appeared reasonable. The basis for choice appeared to be largely interest, but values and aptitude appeared as bases 4 to 6 grade-levels below those suggested by Ginzberg.

Institute for Research in Social Science, U. of North Carolina, Chapel Hill.
ANNUAL TECHNICAL REPORT. Rept. for 1 Nov 58-31 Oct 59 on Contract Nonr-855(04). [1959] 10p. 1 ref.
Order from LC mi$1.80, ph$1.80 PB 149 516

The various studies summarized are grouped under the following headings: Studies of Social Perception, Studies Related to the recent book by Thibaut and Kelley, Other Experimental Studies, and A Field Study. (See also PB 143 471)

[Institute for Social Research, U. of Michigan, Ann Arbor]
REFERENCE GROUP PROCESSES IN A FORMAL ORGANIZATION, by Jay M. Jackson. (U. of Kansas). Doctoral thesis. Rept. on Contract N6onr-232(02). [1959] 33p. 31 refs. AD-218 325.
Order from LC mi$3.00, ph$6.30 PB 147 897

Research is reported which was directed toward increasing understanding of some of the reference group processes. The following hypothesis were formulated and tested: (1) in any group or organization, a person's attraction to membership will be directly related to the magnitude of his social worth; (2) the magnitude of the positive relationship hypothesized above will vary directly with the volume of interaction the person has with other members of the group or organization under consideration; (3) where alternative group orientations are possible for a person, his relative attraction to membership in one or another group will be directly related to his relative social worth in the group considered; and (4) the magnitude of the positive relationship hypothesized in (3) will vary directly with the volume of interaction the person has with the members of the groups under consideration. Questionnaire data were obtained from 72 staff members of a child welfare agency. The sample consisted of 46 professional and 26 nonprofessional men and women. Hypotheses were tested by computing Pearson product-moment correlations between measures of attraction and social worth. Results indicated that the hypotheses and the assumptions from which they were drawn are supported. The findings point more specifically to the populations, conditions, and context in which the generalizations may hold true. Correlations were computed for high and low contact groups, for professionals and nonprofessionals, supervisory and nonsupervisory personnel, and for work-groups relative to the rest of the organization. None of the relationships approached statistical significance.

Institute of Psychiatry, Maudsley Hospital, London (Gt. Brit.)
RATE OF TEMPORAL AND SPATIAL INHIBITION IN HYSTERIA AND BRAIN DAMAGE IN NORMAL, NEUROTIC, AND BRAIN-DAMAGE SUBJECTS. Final technical rept. for 1 May 59-30 Apr 60 on Contract DA 91-591-EUC-1136. [1960[69p. 33 refs.
Order from LC mi$3.90, ph$10.80 PB 149 422

This report has three sections. In the first of these the experimental investigation has been completed. A battery of tests was administered to 16 hysterics, 16 dysthymics, 16 schizophrenics and 16 normal subjects. The second part is made up of three experiments on reminiscence. The third part consists of a report on sedation threshold as a measure of extraversion and inhibition. This report gives findings on hysterics and dysthymics. (See also PB 143 837).

Link Div., General Precision, Inc., Binghamton, N. Y.
A DEVICE AND TESTS FOR MEASURING INTELLECTUAL FUNCTIONS DURING ACCELERATION, by Irwin Miller, George B. Simon, and Edwin Cohen. Rept on Biophysics of Flight, Contract AF 33(616)6467. May 60, 39p. 28 refs. WADD Technical rept. 60-366.
Order from OTS $1.25 PB 171 019

In manned space flights, a vehicle operator will be expected to perform control functions or act as a systems monitor under high levels of acceleration. To determine the extent to which man's intellectual functions might be impaired under high G, a device was designed for use with the WADD human centrifuge. This device, the Link Intellectual Functions Tester (LIFT), can be operated up to 14 G, and features automatic scoring, tabulation of responses, and automatic pacing of stimulus presentation. Three test batteries of 14 one-minute tests were used to evaluate verbal, reasoning, mathematical, and perceptual abilities under the limitations of high G on the centrifuge. The median reliability of the one-minute tests was 0.27; the estimated reliability of the 14-test battery was 0.83. Until new data actually gathered during acceleration are made available, the reliability of all the tests remains undetermined for any values above 1 G. (Author)

Lockheed Aircraft Corp., Marietta, Ga.
HUMAN PERFORMANCE AS A FUNCTION OF THE WORK-REST CYCLE, by Oscar S. Adams and W. Dean Chiles (Aerospace Medical Div.). Rept. on Human Performance in Advanced Systems, Contract AF 33(616)6050. Mar 60, 21p. 11 refs. WADD Technical rept. 60-248.
Order from OTS $0.75 PB 161 958

This study was designed to investigate the effect on performance of four different work-rest period schedules (2 on and 2 off, 4 on and 4 off, 6 on and 6 off, 8 on and 8 off) followed over a period of 96 hours. The subject sample consisted of 16 male college students with 4 subjects being assigned to each of the four work-rest period schedules. Performance was measured by means of a battery of psychomotor tasks involving arithmetic computation, pattern discrimination, monitoring, and vigilance. Additional data were obtained from information recorded in an experimenter's logbook and from responses to a subject questionnaire administered at the end of the testing. Although the performance tasks failed to differentiate among the four experimental groups, the observational evidence suggested that the subjects in the 2-hour and 4-hour groups achieved a more favorable adjustment than those in the other two groups. (Author)

Maryland U., College Park.
A TEST OF UNDERWOOD'S LAW WITH CONNECTED MEANINGFUL MATERIALS, by Charles N. Cofer and Jean C. Holroyd. Technical rept. no. 22 on Learning, Retention and Recovery of Meaningful Material, Contract Nonr-595(04). Apr 59, 6p. 6 refs. AD-220 228.
Order from LC mi$1.80, ph$1.80 PB 148 272

The data offer no support for Underwood's law which, for the recall of discrete syllables, words or pairs, suggests that recall will be inversely related to the number of previous lists which have been learned.

Psychophysical Research Unit, Mount Holyoke Coll., South Hadley, Mass.
EXPERIMENTS ON VISUAL RESEARCH 1956-57, by H. Corbin, J. Carter and others. Final rept. Tasks I and II, on Contract AF 19(604)1713. July 58, 26p. 3 refs. AFCRC-TR-57-59.
Order from LC mi$2.70, ph$4.80 PB 149 541

About six experiments are summarized relating to two research programs: (1) the discrimination of groups of objects (targets) in searching cluttered visual displays; the research emphasized the use of visual aids to increase the efficiency of the discrimination of groups; (2) the speed and accuracy of search and discrimination of near-threshold and above-threshold visual targets in a horizontal array.

Utah U., Salt Lake City.
VARIABLES RELATED TO ACCURACY IN INTERPERSONAL PERCEPTION, by Victor B. Cline and James M. Richards, Jr. Annual rept. no. 1 on Contract [Nonr-1288(04)]. 15 Nov 58, 27p. 23 refs.
Order from LC mi$2.70, ph$4.80 PB 148 793

This project is concerned with the problem of generality of judging ability, to be followed by the study of the personality characteristics, life history experiences, etc., of judges who appear to excell in a general or specific manner in evaluating, assessing and predicting the behavior of fellow human beings. A preliminary study of these external correlates of judging ability is reported.

Washington U., Seattle. Div. of Counseling and Testing Services.
TWO IBM TYPE 650 PROGRAMS TO CORRECT CORRELATION MATRICES FOR ATTENUATION, by Calvin E. Wright. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-743(C4). June 59, 7p. 4 refs. AD-227 961.
Order from LC mi$1.80, ph$1.80 PB 147 891

Two IBM Type 650 programs are reported which were found to be useful in multivariate psychological analyses. The first of these corrects symmetric correlation matrix elements for attenuation. For 1 to 50 variables, the program performs its function when the row and column identifications of the correlation coefficients refer to the variables of a symmetric correlation matrix. The second program is useful for up to a 50 by 50 non-symmetric correlation matrix where the row and column identifications of the correlations refer to 2 distinct sets of 50 variables. The input cards for both programs can be the output cards of the correlation matrix programs reported by Dvorak and Wright, where 4 decimal values are obtained. The output cards of the correction for attenuation programs are also of the correlation matrix programs output form. The location of the decimal can be controlled if desired. (Author)

Yale U., New Haven, Conn.
AUTOTELIC FOLK-MODELS, by Alan Ross Anderson and Omar Khayyam Moore. Technical rept. no. 8 on Contract Nonr-609(16). Nov 59, 19p. 32 refs.
Order from LC mi$2.40, ph$3.30 PB 148 962

This paper is concerned with cultural products which we call autotelic, i.e., cultural products such as puzzles, games of chance, games of strategy, and aesthetic objects, all of which contain their own goals and sources of motivation. Such activities are "cut off" in a sense, from serious and immediate problems of survival and welfare, and are protected by autotelic norms which dictate that participation must not impinge on serious problems. As a heuristic principle for the application of formal methods in sociology, it is suggested that autotelic cultural products may be viewed as folk-models, i.e., models in the prescientific culture, with the help of which members of a society learn about and "play at" the workings of their society.

BIOLOGICAL SCIENCES

California U., Los Angeles. School of Medicine.
NERVOUS CONTROL OF SHIVERING. IX. A REVIEW, by Allan Hemingway. Rept. on Contract AF 18(600)358. July 57, 12p. 9 refs. Technical note AAL-TN-57-40.
Order from LC mi$2.40, ph$3.30 PB 146 618

The research has endeavored to investigate details of nervous control. According to current concepts the nervous control of thermoregulation is under "dual control". One is a "reflex" control resulting from stimulation of thermoreceptors in the skin, i.e. the cold and warmth temperature receptors. The other is a "central" control operated by a rising or falling brain temperature. These experiments, and others not mentioned here, support the dual control theory of temperature regulation. The location of the controlling center in the brain is believed to be in the hypothalamus, the exact position in the hypothalamus with any ramifications and interrelations being unknown.

Naval Research Lab., Washington, D. C.
ELECTROPHORETIC STUDIES ON BACTERIA. PART I. DESIGN AND PERFORMANCE OF AN IMPROVED APPARATUS FOR ELECTROPHORESIS BY THE MICROSCOPE METHOD, by R. A. Neihof. Interim rept. 15 Aug 60, 11p. 16 refs. NRL rept. 5495.
Order from LC mi$2.40, ph$3.30 PB 146 393

An improved apparatus for studying the electrophoresis of bacteria or other particulate matter by the microscope method is described. A simplified and convenient design is permitted by the use of electrodes consisting of palladium foil charged with atomic hydrogen. In contrast to electrodes previously used, this system permits high current densities to be passed without danger of gassing or the use of convection barriers to prevent contamination of the experimental material with heavy metal ions. Temperature control and heat dissipation are facilitated by immersing the apparatus in a water thermostat. The performance of the apparatus is evaluated with gelatin-coated glass particles, bacteria, and human erythrocytes. Mobility measurements which are sufficiently precise and accurate for the intended studies can be readily obtained. (Author)

Anatomy and Physiology

Aerospace Medical [Div.] Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
DESIGN PARAMETERS FOR THE ENGINEERING OF CLOSED RESPIRATORY SYSTEMS, by Donald A. Keating. Rept. on Equipment for Life Support in Flight Operations. Dec 59, 18p. 21 refs. WADC Technical rept. 59-766.
Order from OTS $0.50 PB 161 963

Design data essential to the engineer engaged in the design of closed respiratory systems have been compiled in a compact form for ready engineering reference. The data presented can be considered as design guide lines since man is an ever changing mechanism and each is different within his species. Such data have been presented from an engineering viewpoint to form a foundation of design requirements for closed ecological systems of increasing complexity. (Author)

Aerospace Medical Div., Wright Air Development Div., Wright-Patterson AFB, Ohio.
VARIATIONS IN ABSOLUTE VISUAL THRESHOLDS DURING ACCELERATION STRESS, by William J. White. Rept. on Biophysics of Acceleration. Apr 60, 18p. 7 refs. WADD Technical rept. 60-34.
Order from OTS $0.50 PB 171 009

Measurements are reported on the effects of moderate acceleration upon the absolute thresholds of foveal (cone) and peripheral (rod) vision. This experiment shows that accelerative stress has a consistent and progressive effect on visual performance, this effect being proportional to the magnitude of the positive acceleration. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
BEHAVIORAL MEASUREMENTS ON ANIMALS PARTICIPATING IN SPACE FLIGHT, by Frederick H. Rohles, Jr. Mar 60, 12p. 3 refs. AFMDC-TN-60-5.
Order from LC mi$2.40, ph$3.30 PB 146 972

This report presents the historical background and events leading up to the establishment of the Comparative Psychology Branch at the Aeromedical Field Laboratory. The work being accomplished by this branch is discussed together with problems associated with obtaining behavioral measures on animals participating in space flight. (Author).

Air Force Missile Development Center, Holloman AFB, N. Mex.
PHYSIOLOGICAL BASE-LINE STUDIES OF ZOOLOGICAL SPECIMENS. PHASE I: HEMATOLOGICAL VALUES OF IMMATURE CHIMPANZEES, by James E. Cook, Jerry Fineg and Eldon D. Miksch. July 60, 19p. 7 refs. AFMDC-TN-60-9.
Order from LC mi$2.40, ph$3.30 PB 150 235

The hematological findings for 17 immature chimpanzees are presented. These findings are compared with human and other chimpanzee hematological values in published literature. The blood cellular morphology and hematological values are similar to those of humans of comparable age. The major dissimilarities are discussed. (Author)

Army Medical Research Lab., Fort Knox, Ky.
A REPRESENTATIVE BIBLIOGRAPHY OF RESEARCH IN LOW-FREQUENCY MECHANICAL VIBRATION, by V. H. Schaefer and R. G. Ulmer. Rept. on Psychophysiological Studies. 12 Nov 59, 30p. 188 refs. Rept. no. 405; AD-228 941.
Order from LC mi$2.70, ph$4.80 PB 149 768

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
THE PHYSIOLOGY OF TEMPERATURE REGULATION, by James D. Hardy. Rept. no. 22 on Task MR005.15-2002.1. 9 June 60, 299p. 851 refs. NADC-MA-6015.
Order from LC mi$11.10, ph$45.60 PB 150 139

The present report is restricted to the narrower considerations of the temperature responses of the homoiotherms and, more particularly, of the usual laboratory animals and of man. Even within this limited field there is an enormous current literature and more than three thousand references were reviewed in preparation of the material presented below. The attempt has been to give principal attention to the literature since 1952 although reference is made to much of the older work for purposes of continuity and clarity. It is not believed practical to separate temperature regulation from the physiological responses to heat and to cold and for this reason the present review is divided into: (a) physiological responses to cold, (b) physiological responses to heat, and (c) the physiology of temperature regulation.

Buffalo U., School of Medicine, N. Y.
STUDIES IN PULMONARY PHYSIOLOGY: CHEMISTRY, MECHANICS, AND CIRCULATION OF THE LUNG, by Hermann Rahn. Rept. on High-Altitude Physiology, Contracts AF 33(616)3834 and AF 33(616)5606. Apr 60, 162p. 5 refs. WADD Technical rept. 60-1.
Order from OTS $3.00 PB 161 984

The scientific papers compiled in this report on various aspects of pulmonary gas exchange have been divided into the following groups: Cardiovascular-Pulmonary Reactions to Pressure Breathing, Carbon-Dioxide Stores of the Body, Gas Tension in Tissues and Biological Fluids, Alveolar-Arterial Oxygen Difference and Theoretical Considerations of Pulmonary Ventilation, Perfusion and Diffusion. (Author).

California U., Los Angeles.
REPETITION AND CONFIRMATION OF MESSAGES RECEIVED BY EAR AND BY EYE, by Edward C. Carterette and Michael Cole. Technical rept. no. 3 on Contract Nonr-233(58). 29 June 59, 29p. 14 refs. AD-220 404.
Order from LC mi$2.70, ph$4.80 PB 147 888

An attempt was made to determine how the auditory and visual modes of reception compare over successive repetitions of a message. The rating method was used to obtain operating characteristics for 60 heterogeneous words, and to make specific comparisons of the visual and auditory modes of reception. The comparisons made showed that over successive repetitions, accuracy of reception is a direct function of the confidence rating and is relatively independent of the intelligibility level. Neither do the accuracy of reception or the distributions of rating categories change markedly over trials. Both visual and auditory data are fitted reasonably well by predictions made from a simple stochastic model based on the assumptions that (1) intelligibility, (2) probability of a correct acceptance, and (3) probability of an incorrect acceptance remain constant over successive repetitions. Results showed that the concept of operating characteristic as used in the reception of messages in noise may be extended to include vision.

Eye Research Foundation, Bethesda, Md.
RETINAL SENSITIVITY DURING PHOTOPIC ADAPTATION, by R. H. Peckham and W. M. Hart. Technical rept. no. 1 on Contract Nonr-2750(00). 12 Oct 59, 20p. 8 refs. AD-228 069.
Order from LC mi$2.40, ph$3.30 PB 149 859

Retinal responses to measured levels of luminance are reported. The stimulus was that of repetitive short alternations of equal duration, above and below a constant background luminance. The use of this stimulus permitted an estimate of retinal sensitivity by recording the frequency of the perception of scintillation in the stimulus area.

Florida U. Coll. of Medicine, Gainesville.
INTERACTION OF ADRENAL AND THYROID HORMONES IN MAINTENANCE OF BODY TEMPERATURE OF RATS EXPOSED TO COLD, by Melvin J. Fregly. May 60, 16p. 33 refs. AFSAM rept. 60-47; AD-239 977.
Order from LC mi$2.40, ph$3.30 PB 149 245

The effects of cortisone acetate and thyroxine, administered separately or in combination, on colonic cooling rate (CCR) were studied in restrained, adrenalectomized rats subjected to cold air (5°C.). Thyroxine alone at 5.0 μg./day reduced the rapid CCR of adrenalectomized rats but failed to return it to that of sham-operated rats. Cortisone acetate alone at 1.0 mg./day also reduced CCR but failed to return it to that of sham-operated rats. Administration of 5.0 μg. thyroxine per day simultaneously with 2.0 to 2.5 mg. cortisone acetate returned CCR to that of sham-operated rats. However, CCR of rats given 2.5 μg. thyroxine and cortisone daily failed to return to that of sham-operated rats. Simultaneous administration of cortisone acetate with graded doses of thyroid-stimulating hormone (TSH) resulted in a greater reduction of CCR than with either treatment alone. With respect to CCR, cortisone acetate did not appear to interfere either with thyroid gland response to TSH administration or to tissue utilization of thyroxine. (Author).

Jefferson Medical Coll., Philadelphia, Pa.
HORMONAL AND NERVOUS FACTORS IN THE RAT'S TOLERANCE TO REDUCED BAROMETRIC PRESSURE, by D. A. DeBias and K. E. Paschkis. May 60, 11p. 11 refs. AFSAM Rept. no. 60-58.
Order from LC mi$2.40, ph$3.30 PB 150 206

The effects of neuropharmacologic agents on the tolerance of adrenalectomized rats to a barometric pressure of 249 mm. Hg (equivalent to an altitude of 27,800 feet) for a period of 6 hours were studied. Dibenamine, antrenyl, pendiomide ditartrate, thorazine, and amphetamine did not improve the animals' tolerance. The survival time of adrenalectomized-thyroidectomized rats was significantly increased (from 2.7 hours to 5.7 hours) by a dose of cortisol sodium succinate which fails to prolong survival of the adrenalectomized animal. Some of the neuropharmacologic agents used have previously been found effective in other forms of stress. (Author)

Life Support Systems Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
CLOSED CIRCUIT RESPIRATORY SYSTEMS SYMPOSIUM. Rept. on Equipment for Life Support on Astronautical Operation. Aug 60, 470p. 164 refs. WADD Technical rept. 60-574.
Order from OTS $6.00 PB 161 988

This report presents various papers concerning Closed Circuit Respiratory Systems. Papers include those presented or submitted by various contractors, and Governmental Agencies. The specific areas which are presented include (a) concentration of expired carbon dioxide gas (b) concentration of expired water vapor (c) decomposition of carbon dioxide recovering all useful fractions, especially all useable oxygen for breathing purposes (d) decomposition of water yielding breathing oxygen and useful hydrogen (e) complete and continuous miniaturized instrumentation for a closed circuit breathing system. The papers represent the most advanced state of the art which is known to this Division in the related fields as determined by the representation and participation of such a universal group of representatives in the field of closed circuit breathing system. (Author)

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D. C.
AN EVALUATION OF THE EQUIVALENT AIR DEPTH THEORY, by J. A. Logan. 28 July 60, 16p. 9 refs. Research rept. 1-61.
Order from LC mi$2.40, ph$3.30 PB 150 274

U. S. Navy divers performed working dives on air and on nitrogen-oxygen mixtures other than air with equivalent partial pressures of nitrogen. Results of these dives were then scored in three manners. Inspection of the data revealed a difference in the scores, the dives on the nitrogen-oxygen mixtures appearing to produce higher scores than those on air. Statistical analysis, however, failed to demonstrate any significant differences between the scores of the various comparable dives. It was concluded that the mixed gas decompression system now in use is adequate for decompression. This experiment supports the view that oxygen does have some effect on the decompression problem, however, it is slight and statistical significance could not be demonstrated. (Author).

Navy Experimental Diving Unit, Naval Weapons Plant, Washington, D C.
PERFORMANCE IMPAIRMENT AS A FUNCTION OF NITROGEN NARCOSIS, by R. J. Kiessling and C. H. Maag. 1 June 60, 25p. 25 refs. Research rept. 3-30.
Order from LC mi$2.70, ph$4.80 PB 150 273

Navy divers individually performed air dives in a high pressure chamber for 40 minutes at a simulated depth of 100 feet. Each experimental session consisted of three phases: a measure of performance on choice reaction time, motor coordination, and conceptual reasoning at sea level in the chamber; three 12 minute periods at a pressure equivalent of 100 feet of sea water, during which equal time was allocated to each of the three tests; and a final measure during the decompression stop at 10 feet. All subjects had been trained to plateau level of performance before the experiment proper had begun. Statistically significant decreases in performance for all subjects on all tests were found, with the greatest decrement occurring on the reasoning test, least on motor coordination. Decreased performance occurred as the pressure increased and remained relatively constant with duration of exposure. (Author).

School of Aviation Medicine, Brooks AFB, Tex.
EXTENDING THE RANGE OF THE CARTESIAN DIVER, by Harold L. Bitter, W. O. Baentsch, and Bruce E. Jacobson. Aug 60, 5p. 3 refs. Rept. no. 60-67.
Order from LC mi$1.80, ph$1.80 PB 150 203

A modified Cartesian diver was designed and fabricated in an effort to obtain accurate tissue respiration results in an area not previously covered by the Cartesian diver technic. The resulting apparatus allows greater range in biologic sample size, is easier to load, and requires less accessory equipment — resulting in less chance for sample contamination. (Author)

Biochemistry

Arctic Aeromedical Lab., Ladd AFB, Alaska.
OBSERVATIONS ON THE BIOCHEMICAL BASIS OF CHEMICAL THERMOGENESIS IN THE COLD-ACCLIMATED RAT, by Robert E. Beyer (Tufts U School of Medicine). Apr 60, 10p. 26 refs. AAL-TN-60-6.
Order from LC mi$1.80, ph$1.80 PB 150 026

Several mechanisms concerning the increased thermogenesis resulting from exposure of the laboratory rat to a cold environment are discussed. It is postulated that adrenal medullary hormones mediate an increase in the efficiency of mitochondrial oxidative phosphorylation, and thus provide adequate adenosine triphosphate for accelerated muscular activity during the initial stage of cold acclimation. The second, or chemical, phase of increased thermogenesis may be accounted for by a lowering of mitochondrial respiratory control in the electron transport chain. The possible meditation thyroid hormone is also discussed. (Author)

Army Medical Research Lab., Fort Knox, Ky.
CARBOHYDRATES OF HUMAN AND BOVINE PLATELETS, by E. E. Woodside and W. Kocholaty. Rept. on Biological and Medical Aspects of Ionizing Radiation. 1 Sep 59, 19p. 39 refs. Rept. no. 395; AD-228 935.
Order from LC mi$2.40, ph$3.30 PB 149 767

Average values for the total carbohydrate content of human and bovine platelets were 8.4% and 8.77% of the dry weight, respectively. On a dry weight basis, human platelets were calculated to be approximately one-third larger than bovine platelets. By chemical and chromatographic analysis, glucose, galactose, mannose, fucose, ribose, glucosamine, galactosamine, glucuronic acid, and sialic acid were detected in both human and bovine platelets. Glucose and ribose were found to be the only monomers present in the 5% trichloroacetic acid (TCA) soluble fractions of both human and bovine platelets. The TCA insoluble residue contained glucose, galactose, mannose, fucose, ribose, glucuronic acid, glucosamine, galactosamine, and sialic acid. The acid mucopolysaccharide fraction of both human and bovine platelets contained galactosamine and glucuronic acid monomers as well as galactose, glucose and ribose. Glycogen was found in both human and bovine platelets. Total glycogen was extracted by 5% TCA from sonorated human and bovine platelets; however, subsequent ethanol precipitation of the glycogen was incomplete. In contrast, 30% potassium hydroxide extraction followed by ethanol precipitation resulted in complete recoveries of the glycogen. Variations in both total hexose and glycogen contents existed in both human and bovine platelets. These variations were partially dependent on the length of storage of the platelets in whole blood or in 0.85% sodium chloride after separation from whole blood. (Author)

Liege U. (Belgium).
ISOTOPE STUDIES ON BONE SALTS, by Marcel J. Dallemagne and Leon Richelle. June 60, 18p. 54 refs. Aeromedical Reviews 1-60.
Order from LC mi$2.40, ph$3.30 PB 150 204

The principal purpose of this study is to define bone and tooth salts. The main conclusions drawn are as follows: Bone and dentin mineral isolated from the organic matrix and studied by means of isotope method behave just as hydrated synthetic phosphates. Synthetically, compounds closely approximating bone, dentin, or cementum may be precipitated under well-defined conditions. However, the chemical composition of the biologic and the synthetic compounds is not absolutely the same, since these phosphates do not arise in a liquid phase with the same composition as fluids circulating in bone.

Naval Radiological Defense Lab., San Francisco, Calif.
INHIBITION OF DNA SYNTHESIS BY SODIUM IONS, by E. R. Walwick and R. K. Main. 12 May 59, 8p. 12 refs. Research and development technical rept. USNRDL-TR-319; AD-218 929.
Order from LC mi$1.80, ph$1.80 PB 147 613

Studies concerning the synthesis of DNA in a readily available and controllable in vitro system were initiated. A reliable method of measuring tritiated thymidine incorporation into DNA, as detected by a liquid scintillation counting technique, was devised and tested. It was found that sodium ions at concentrations within physiological limits and in the presence of optimal amounts of Mg^{++} ions markedly inhibit DNA synthesis.

University of Southern California. School of Medicine, Los Angeles.
STORAGE AND METABOLISM OF FED CARBOHYDRATE, by Douglas R. Drury. Rept. on Contract AF 18(600)567. Nov 57, 32p. 6 refs. Technical note AAL-TN-57-46.
Order from LC mi$3.00, ph$6.30 PB 150 023

The 24-hour-fed rats had, on the average, the equivalent of 2.5 grams glucose deposited as body fat. However, each gram of glucose converted to fat requires the expenditure of an additional 0.27 grams glucose to effect the conversion. In other words the fat that contains the amount of carbon that is in one gram of glucose is isocaloric with 1.27 grams glucose. The 2.5 grams of glucose deposited as body fat represents the amount of energy contained in 3.1 grams glucose. This is equivalent to 12.8 calories. The expected caloric requirement for these rats would be about 21 calories per day. Carcass fat therefore accounts for about 60% of stored carbohydrate. (Author).

Uppsala U. (Sweden).
INVESTIGATION OF THE METHODS FOR SEPARATING BIOLOGICALLY AND MEDICALLY IMPORTANT SUBSTANCES OF LARGE MOLECULAR WEIGHT, by A. Tiselius. Final technical rept. no. 2 on Contract DA 91-591-EUC-1025. 30 May 60, 61p. 21 refs.
Order from LC mi$3.90, ph$10.80 PB 149 428

Contents:
Development of zone electrophoresis
Zone electrophoresis in packed vertical columns and in gels
Zone electrophoresis in gel suspensions
Free zone electrophoresis in a revolving tube
Fractionation of particles and macromolecules of biological origin using liquid two-phase systems
Fractionation of particles utilizing stratification by density in packed semi-solid centrifugal sediments
Methodological studies of protein chromatography

Botany

California Forest and Range Experiment Station, Berkeley.
CROWN CHARACTERISTICS OF SEVERAL CONIFEROUS TREE SPECIES: RELATIONS BETWEEN WEIGHT OF CROWN, BRANCHWOOD AND FOLIAGE, AND STEM DIAMETER, by Theordore G. Storey, W. L. Fons, and F. M. Sauer. Interim technical rept. Aug 55, 91p. 26 refs. AFSWP-416.
Order from LC mi$5. 40, ph$15. 30 PB 150 675

This report released for sale to the public 11 Oct 60.

Prediction of wind breakage and uprooting in tree stands requires information on weight of dry crown, branchwood, and foliage. An experimental program started in 1951 has led to a number of generalized relations by which these crown characteristics can be determined with good accuracy over a wide range of tree diameters, species, and species groups.

University Coll., Galway (Eire).
THE STRUCTURE OF THE PHYCOBILINS. Final rept. for 1 Mar 59-29 Feb 60 on Contract DA 91-591-EUC-1071. [1960] 16p.
Order from LC mi$2. 40, ph$3. 30 PB 149 434

A chemical study of the algal chromoproteins, phycoerythrins and phycocyanins was undertaken. Representatives of the various types of chromoproteins were isolated from red algae, blue-green algae and cryptomonads. The water-soluble chromoproteins were purified by ammonium sulphate fractionation and/or by column chromatography. Paper chromatographic analyses of hydrolysed chromoproteins revealed the presence of all the common amino acids. A feature of all the proteins examined was the preponderance of dicarboxylic over basic amino acids and their high alanine and leucine contents. N- and C- terminal groups of the chromoproteins were determined quantitatively, using a variety of methods. Approximately 20 terminal groups of both types per molecular weight unit of phycoerythrins and phycocyanins were found. The chromophores (phycobilins) of these chromoproteins are related to the bile pigments. The chromophore-protein attachment was investigated in a number of cases. Previous evidence indicated that a peptide linkage joined the chromophore to the protein, but that a second labile bond was also involved. The ε-amino group of lysine does not appear to participate in peptide-bond formation in R- phycoerythrin, as all those groups were found to be free.

Medical Specialties and Equipment

Arctic Aeromedical Lab., Ladd AFB, Alaska.
DROPPABLE, AUSTERE MEDICAL FACILITY, by Norman C. Van Tassel. July 57, 36p. Technical note AAL-TN-57-22.
Order from LC mi$3. 00, ph$6. 30 PB 150 021

This report describes an Austere Medical Facility developed to furnish paramedical personnel with air-droppable supplies and equipment to care for and maintain 10 casualties for 10 days under Arctic and subarctic field conditions. In the severe environment of these regions, it is usually not feasible to render definitive medical treatment in the field, and the facility is intended only to aid in maintaining life and to minimize suffering until evacuation can be accomplished. Most of the supplies and equipment used are standard Air Force items. The facility is packaged to allow air-drop from cargo type aircraft and designed so that it can be operational within approximately 1 hour after arrival over the drop zone. It has been tested and found to be satisfactory for use on snow covered terrain and on sea ice. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
PACKAGING FREEZABLE EMERGENCY KIT ITEMS, by John D. Fulton and Jack D. Douglas. Mar 60, 15p. 2 refs. Technical note AAL-TN-60-2.
Order from LC mi$2. 40, ph$3. 30 PB 150 025

It is considered that the most practical approach for providing suitable insulated containers would be to procure molded styrene foam shells, with a suitable inside volume, which would fit into a standard, medical kit chest. Proper containers could be provided at minimum cost by this method. Based upon lists of the various emergency kit items provided by representative hospitals within the AAC, the required number and size of the containers recommended for each type of kit are shown.

Pathology

Army Chemical Corps., Fort Detrick, Md.
GRAPHIC SUMMARY OF SELECTED INFECTIOUS DISEASES, by Phebe W. Summers. Second edition, 1960, 65p. [Pub. 132]
Order from LC mi$3. 90, ph$10. 80 PB 150 236

The purpose of the Graphic Summary is to tabulate for quick reference salient points about selected diseases which may be of significance to the health of the public in the event of biological warfare attack either directly on man or indirectly on his animal protein food supply. This second edition brings information more up-to-date and presents data more completely and, it is hoped, more logically.

Army Chemical Warfare Labs., Army Chemical Center, Md.
A PRIMARY PULMONARY NEOPLASM IN THE GOAT, by Erwin G. Pearson. May 60, 15p. 13 refs. CWLR-2397; AD-239 306.
Order from LC mi$2.40, ph$3.30 PB 149 906

A type of pulmonary tumor found occasionally in Angora goats is reported. The tumor is composed of nests of squamous cells growing in a small amount of connective tissue stroma. The tumor arises from metaplastic bronchial epithelium. The neoplasm shows no definite signs of malignancy, and is considered to be a benign papilloma. (Author)

Chemisches Institut, Marburg (West Germany).
SEROLOGY OF DNA, by H. Witzel. Final rept. for 15 Jan 59-15 Jan 60 on Contract DA 91-591-EUC-1043. [1960] 14p.
Order from LC mi$2.40, ph$3.30 PB 149 338

The purpose of this program was: (1) to define more closely the anti-DNA (desoxyribonucleic-acid) reactions which can be detected in about two thirds of the patients suffering from systemic lupus erythematosus; (2) to study clinically and serologically patients suffering from systemic lupus erythematosus.

School of Aviation Medicine, Brooks AFB, Tex.
HUMAN CARDIOACCELERATIVE RESPONSES TO HYPOXIA IN COMBINATION WITH HEAT, by Henry B. Hale. Sep 59, 14p. 7 refs. Rept. 60-14; AD-229 899.
Order from LC mi$2.40, ph$3.30 PB 150 283

The effects of high ambient temperature on heart rate responses to moderate reductions in oxygen pressure were determined in healthy human males. With air temperature approximating 50° C., and hypoxia equivalent to that at 14,000 or 18,000 feet altitude, most of the subjects showed intensified responses; but several experienced marked bradycardia and syncope (or near syncope). Both kinds of response indicate that special precautions should be taken in flying operations to avoid the occurrence of even mild degrees of hypoxia when ambient temperature is relatively high. (Author).

Pharmacology and Toxicology

Army Chemical Research and Development Labs., Army Chemical Center, Md.
THE PROTECTIVE ACTION OF THE OXIMES P2S AND 2-PAM LACTATE ALONE OR AS ADJUNCTS AGAINST GB VAPOR IN DOGS, by James W. Crook, Alvin I. Goodman and others. July 60, 15p. 6 refs. CRDLR-3021.
Order from LC mi$2.40, ph$3.30 PB 150 223

P2S and 2-PAM lactate administered orally in doses of 30 to 75 mg/kg 2.5 to 4 hours prior to lethal exposures to GB vapor (6 to 9 LCt50's) offer effective protection to dogs when supported by an intramuscular dose of atropine (5 mg/kg) within 1 minute after exposure. Neither of the oximes is effective treatment when given alone. 2-PAM lactate and atropine mixtures given intravenously to dogs 1 minute after a lethal exposure to GB vapor also offer adequate protection. Intramuscular administration of this mixture is ineffective.

Army Chemical Warfare Labs., Army Chemical Center, Md.
LIST OF REPORTS PUBLISHED UNDER THE HEALTH HAZARDS OF MILITARY CHEMICALS PROGRAM TO 1 MAY 1957. 30 July 57, 15p. 146 refs. CWL Special pub. 2-1.
Order from LC mi$2.40, ph$3.30 PB 150 546

This report released for sale to the public 11 Oct 60.

Reports are listed under: Acetylene derivatives; ammonia; aniline; boron compounds; cleaning agents; clothing impregnating agents; epoxides; fluorine compounds; furfuryl alcohol; halogenated hydrocarbons (fire extinguishants); hydraulic and lubricating fluids; hydrazine and derivatives; hydrogen peroxide; mercaptans; nitric acid; nitro compounds, nitrites and nitrates; perchlorates; tetrazoles; general.

Army Chemical Warfare Labs., Army Chemical Center, Md.
PULMONARY AND CARDIOVASCULAR EFFECTS OF SARIN IN TREATED DOGS, by Glenn D. Lubash, Irwin Gribetz, and Rudolph P. Johnson. June 60, 19p. 20 refs. CWLR-2389; AD-239 153.
Order from LC mi$2.40, ph$3.30 PB 149 970

Peripheral vascular collapse is an important cause of death, despite therapy with atropine and artificial respiration, after enormous doses of ChE inhibitors. Sarin was used to induce hypotension in dogs. Blood pressure was maintained despite injections as large as 500 LD50's when artificial respiration and atropine were used. Intravenous atropine reversed elevated tracheal pressures and heartblock. Metaraminol, norepinephrine, and molar sodium lactate administered after atropine and artificial respiration produced no satisfactory responses in hypotensive (and hypoxic) animals. Normotensive animals given metaraminol had significant complications with rise in blood pressure. The value of treatment with atropine and artificial respiration is re-emphasized. (Author)

[Army] Chemical [Warfare] Labs., Army Chemical Center, Md.
THE RABBIT AND RAT AS TEST ANIMALS FOR SCREENING CANDIDATE FOR TREATING NERVE GAS POISONING, by J. H. Wills, G. E. Groblewski, and L. M. Somers. June 54, declassified 9 June 60, 12p. Medical Labs. Research rept. no. 289.
Order from LC mi$2.40, ph$3.30 PB 150 123

Parallel assays of the comparative prophylactic potencies in GB poisoning of a series of 9 atropine-mimetic compounds in the rabbit and the rat yielded a coefficient of rank correlation of +0.71. A similar comparison of 7 bis-quaternary, ganglionic-blocking drugs, administered as adjuncts to atropine, yielded a coefficient of rank correlation of +0.11.

Ohio State U. Research Foundation, Columbus.
CARDIO-RESPIRATORY RESPONSES TO ENVIRONMENTAL STRESS, by Fred A. Hitchcock. Final rept. on Contract DA 49-007-MD-189. June 59, 81p. 62 refs. Rept. no. 479; AD-226 852.
Order from LC mi$4.80, ph$13.80 PB 149 999

The first two portions of this report deal with the cardio-respiratory effects of carbon monoxide inhalation in the anesthetized dog. Section one involves a study of the adaptive responses to sublethal concentrations of carbon monoxide. Here emphasis was placed on the pulmonary ventilation and its regulation and related changes in blood gas tensions and acid-base balance. Section two deals with the cardio-respiratory events preceding death due to inhalation of lethal concentrations of carbon monoxide. In this phase major interest was with respect to cardiac output, blood pressure, peripheral resistance, and pulmonary ventilation. A characteristic pattern of peripheral collapse, hypotension, and decline in cardiac output preceded by irregular respiration was observed. The abruptness of the final hemodynamic collapse was striking. The third and last section of this report describes preliminary investigation into the problem of distribution of inspired air among the pulmonary alveoli. A theoretical equation is derived describing the decline in alveolar nitrogen concentration following inhalation of oxygen where the oxygen mixed homogeneously with the functional residual air. An "efficiency index" based on the ratio of the observed decrement in alveolar nitrogen concentration to the theoretical decrement was then developed. Data obtained on normal human subjects indicated considerable variation in pulmonary "mixing efficiency" from breath to breath. (Author)

Radiobiology

Public Health Service, Washington, D. C.
RADIOLOGICAL HEALTH DATA. VOLUME I, NO. 6. Monthly rept. Sep 60, 61p. 2 refs.
Order from OTS $0.50, $3.00/6 mos. PB 161 371-6

Contents:
Sect. 1. Milk: Public Health Service milk monitoring network; stronium-90 in Canadian dried milk products
Sect. 2. Air: Public Health Service radiation surveillance network; data on radioactivity in air (May 60)
Sect. 3. Water: Public Health Service national water quality network; monitoring of water supplies around the Nevada Test Site (Jan-Feb 60, and Mar-Apr 60)
Sect. 4. Other data: external gamma; food; analytical reference service
(See also PB 161 371-5)

Radiobiological Lab., U. of Texas, Austin.
LIQUID SCINTILLATOR BETA COUNTING OF IRON-59 IN CLEAR AND COLORED SYSTEMS, by Thomas P. Leffingwell, Robert W. Reiss, and George S. Melville. Mar 60, 11p. 14 refs. AFSAM rept. 60-15.
Order from LC mi$2.40, ph$3.30 PB 148 081

National Bureau of Standards $Fe^{59}Cl_3$ was employed in model systems to quantitate liquid scintillator beta counting of Fe^{59}. In systems which contain a colored iron-orthophenanthroline chelate, decline in counting efficiency is a linear function of color density for the concentration gradient investigated. However, presence of the colored chelate causes an increased photon yield relative to the corresponding visibly colorless sample. The enhanced photon yield elevates the entire coincidence counting efficiency curve by approximately 6 percent. The enhancement phenomenon is (1) chelate concentration dependent, (2) beta particle energy dependent, (3) at its maximum at the emission peak of the scintillators in the counting system employed, (4) effected only in the presence of the scintillators, and (5) gamma ray independent. (Author) (See also PB 138 120)

School of Aviation Medicine, Brooks AFB, Tex.
THE EFFECTS FROM MASSIVE DOSES OF HIGH DOSE RATE GAMMA RADIATION ON MONKEYS, by John E. Pickering, Wright H. Langham, and Walter A. Rambach. [1959] 415p. 132 refs. Rept. 60-57.
Order from LC mi$11.10, ph$62.10 PB 150 220

Twenty-eight thousand curies of an equilibrium mixture of Ba-La^{140} were used to expose groups of Macaca rhesus to radiation doses of from 880 to 40,000 r at a dose rate of 1,000 r/min. Survival time varied inversely with the total delivered dose, although there is a dose range in which survival time is independent of total dose. Cinematography shows alternating periods of almost complete incapacitation and partial recovery. Measurable hematological changes can be produced as early as 5 min after the start of radiation at 1,000 r/min, maximal effects can be reached within 10 to 20 min, and some recovery can occur even while additional radiation exposure is continued. Rhesus monkeys demonstrate (a) accelerated respiration rate at all radiation doses except the 1,000-r, (b) increased tidal volume with 1,000-r and 2,500-r doses and a decrease with larger doses, (c) no significant changes in the respiratory minute volume with 1,000 r, a marked increase with 2,500 r, and a progressive decrease with dose with larger radiation doses, and (d) a slightly elevated oxygen consumption rate with 1,000 r, no significant change with 2,500 r and a suppression with the larger doses. Blood lactate levels increase immediately following exposures, and blood pyruvate increases at the higher doses. Ocular changes occur only if the eyes have been irradiated directly. Acute cytologic effects were less conspicuous in monkeys exposed to mixed neutron and gamma irradiation than in animals receiving comparable doses of irradiation from a pure gamma source. There is a reversal in the degree of biologic response within a fixed time interval, as judged by the extent of cellular destruction.

Tracerlab, Inc., Waltham, Mass.
[TABLE OF CARBON-14 RADIOACTIVITY MEASUREMENTS ON SAMPLES OF PLANT EXTRACTS]. Final rept. for 1 Sep-31 Dec 57. AD-213 157.
Order from LC mi$1.80, ph$1.80 PB 150 124

The results are tabulated of carbon-14 radioactivity measurements on samples of plant extracts obtained from plants treated with carbon-14 labeled compounds. Analysis of each sample was performed by combustion of all or a portion of the plant material to $C^{14}O_2$, distillation and purification of the gas before its introduction into an ionization chamber, and counting of the gas using a Lindemann-Ryerson electrometer. (Author)

Walter Reed Army Inst. of Research, Washington, D. C.
THE DETERMINATION OF INTERNALLY DEPOSITED RADIOACTIVE ISOTOPES IN THE MARSHALLESE PEOPLE BY EXCRETION ANALYSIS, by Kent T. Woodward, Ariel G. Schrodt and others. [1960] 19p. 11 refs. DASA-1180.
Order from OTS $0.50 PB 161 950

Since resettlement of the Marshallese people on Rongelap atoll in July 1957, the urinary excretion level of cesium^{137} has increased about 140 fold and about 20 fold for strontium^{90}. Zinc^{65} was readily detected in samples from the March 1958 medical survey. The estimated mean body burden at equilibrium for cesium^{137} is about 1.5 microcuries or about 1/6 of the tolerance recommended by the International Commission for Radiological Protection for non-industrial populations. For strontium^{90} the mean body burden of the exposed Rongelap group in March 1958 was estimated to be two millimicrocuries. This is about nine percent of the expected equilibrium value of 23 millimicrocuries. The equilibrated strontium^{90} burden is about 1/5 of tolerance. The estimated mean body burden of zinc^{65} for Rongelap subjects in March 1958 is about 85 percent of the equilibration value of 0.6 microcuries and the equilibration value is 1/70 of tolerance. (Author)

CHEMISTRY

Inorganic Chemistry

North Carolina U., Chapel Hill.
THE DONOR PROPERTIES OF TRIPHENYLARSINE OXIDE, by David J. Phillips and S. Y. Tyree. Technical rept. no. 5 on The Synthesis of New Inorganic Molecules, Contract Nonr-855(05). 1 Sep 59, 19p. 25 refs. AD-230 255.
Order from LC mi$2.40, ph$3.30 PB 148 861

The coordination chemistry of triphenylarsine oxide with a variety of acceptors has been investigated. New substances have been isolated and characterized by molecular conductance measurements in nitrobenzene, cryoscopic molecular weight measurements in freezing nitrobenzene, magnetic susceptibility measurements, and infrared spectra. Most of the halides appear to be non-electrolytes, whereas the nitrate and perchlorates appear to be saltlike.

Pennsalt Chemicals Corp., Wyndmoor, Pa.
THE COMPOSITION AND PROPERTIES OF ZIRKLOR, by F. L. Scott, H. Q. Smith, and I. Mockrin. Technical rept. no. 7 on Contract Nonr-2687(00). 10 Sep 59, 9p. AD-227 024.
Order from LC mi$1.80, ph$1.80 PB 148 863

The Zirklor sample was an inert material, stable towards water and a gamut of organic solvents, but it was attacked by aqueous bases. No intrinsic reaction was noted between Zirklor and sodium methylate in ether. After 6 hr refluxing of Zirklor with sodium ethoxide in ethanol, 13% of the theoretical quantity of available chloride ion was released; 52% was released after 146.5 hr at 78°C. The product was heterogenous and amorphous. An attempt to react Zirklor with benzene in a Friedel-Crafts reaction produced no evidence of any HCl evolution and no appreciable formation of any phenylated zirconium compound.

Organic Chemistry

[Hammersmith Hospital] London (Gt. Brit.)
OPTICAL ROTATORY DISPERSION OF ORGANIC COMPOUNDS, by W. Klyne. Final technical rept. no. 2, 1 May 59-30 Apr 60, on Contract DA 91-591-EUC-1095. 30 May 60, 48p. 12 refs.
Order from LC mi$3.30, ph$7.80 PB 149 429

Contents:
Monosubstituted steroids, carrying substituents at positions 1,2,3,4,6,7,17 and 20.
Disubstituted steroids, with substituents at 3, 17 or 3,20 or other positions
Steroid ketones.
  Effect of remote and near substituents
  Δ^6-3-ketones
  D-Homo-17a-ketones
  Benzylidene ketones
Sulphoxides
Lignans
Tetrahydroisoquinolines and emetine alkaloids

Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.
PERFLUOROVINYLBORON COMPOUNDS [AND] DIALKYLBIS (PENTAFLUOROETHYL) TIN COMPOUNDS, by F. G. A. Stone, S. L. Stafford and P. M. Treichel. Rept. on Contract AF 49(638)518. June 60, 12p. 17 refs. AFOSR-TN-60-552; AFOSR-TN-60-478, AD-242 310.
Order from LC mi$2.40, ph$3.30 PB 150 339

Ohio State U. Research Foundation, Columbus.
SYNTHESIS OF HETEROCYCLIC COMPOUNDS, by Michael P. Cava. Final rept. for 1 June 55-30 Nov 57. 1 Dec 57, 29p. AD-156 963.
Order from LC mi$2.70, ph$4.80 PB 150 125

It is well known that derivatives of phenoxyacetic acid, especially those bearing halogen substituents in the ring, may show marked plant hormonal activity. The objective of the work described here was to prepare a number of heterocyclic analogs of such compounds.

The basic series chosen for intensive study was the pyridine series; more specifically, the synthesis of substitution products and analogs of 2-pyridoxyacetic acid were given primary consideration. (Author)

Purdue U., Lafayette, Ind.
ATTEMPTED VIOLATIONS OF THE RULE OF TRANS-NUCLEOPHILIC ADDITION, by W. E. Truce, W. Bannister and others. Rept. on Contract AF 49(638)531 and National Science Foundation Grant G9929. 15 June 60, 5p. 9 refs. [AFOSR]TN-60-726.
Order from LC mi$1.80, ph$1.80 PB 149 322

Physical Chemistry

Aerojet-General Corp., Azusa, Calif.
A TEMPERATURE-CONTROL METHOD FOR USE BETWEEN 4.2 AND 77°K, by John M. Flournoy, Lillian H. Baum, and Seymour Siegel. Rept. on Contract AF 18(603)110. Aug 60, 12p. 3 refs. Aerojet rept. TN-37; AFOSR-TN-60-760.
Order from LC mi$2.40, ph$3.30 PB 150 164

Avco-Everett Research Lab., Mass.
OXYGEN VIBRATION AND DISSOCIATION RATES IN OXYGEN-ARGON MIXTURES, by M. Camac and A. Vaughan. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. Dec 59, 86p. 30 refs. Research rept. 84; AFBMD-TR-60-22; AD-234 035.
Order from LC mi$4.80, ph$13.80 PB 147 830

Experimental measurements of vibration and dissociation relaxation of O_2 in O_2-Ar mixtures were obtained from 1200° K to 8000° K. The vibration and dissociation relaxation rates become comparable at about 8000°K temperature. The experimental data indicates that there is at least a factor of 2 decrease in the dissociation rate at high temperatures (above 8000°K) where the vibration is not in equilibrium. (Author)

Aviation Medical Acceleration Lab., Naval Air Development Center, Johnsville, Pa.
ON AUTOMATIC CHEMICAL KINETICS ANALYZER, by Freeman W. Cope. Rept. no. 8 on Task MR005.15-0002.7. 8 Aug 60, 21p. 4 refs. NADC MA-6024; TED Proj. ADC RS-7045-5915M.
Order from LC mi$2.40, ph$4.80 PB 150 222

This paper describes equipment that automatically produces a graph of the mass-action differential equation of a chemical reaction while the reaction is taking place. From a spectrophotometer or other instrument, this apparatus accepts a voltage that is proportional to the concentration (x) of one of the reactants. It computes $\frac{dx}{dt}$ continuously and automatically and plots a graph of $\frac{dx}{dt}$ vs. x. Inspection of this graph immediately shows whether zero, first, or higher order kinetics are involved. Zero and first order rate constants can be directly measured from the graph. Electrical filtering usually must be used to reduce the high frequency noise which is amplified by the differentiator circuit. The effects of the filtering on the mass-action differential equation plot are described in detail. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
NON-AQUEOUS SOAP BUBBLES FOR FLAME STUDIES, by F. Kaufman and H. J. Cook. Jan 52, 8p. 4 refs. Technical note no. 575.
Order from LC mi$1.80, ph$1.80 PB 149 671

Entirely non-aqueous and non-volatile detergent solutions were developed for use in flame velocity measurement work. Chemical compatibility with various gases, diffusion effects, and vapor pressure determinations are described. (Author)

California U., Berkeley.
KINETICS OF FAST HOMOGENEOUS GAS REACTIONS, by Harold S. Johnston and Henry J. Bertin, Jr., Doctoral thesis (Stanford U.) Technical rept. on Contract Nonr-222(56). [1957] 44p. 26 refs. AD-226 150.
Order from LC mi$3.30, ph$7.80 PB 147 577

Heat of formation of nitrosyl fluoride: The absorption spectrum of nitrosyl fluoride was obtained in the near UV, and the 3 fundamental frequencies of the excited electronic state were determined. A rough estimate of the dissociation energy of the excited electronic state was obtained from the observed progressions. The dissociation energy of the ground electronic state was obtained indirectly by the thermochemical determination of the heat of the nitric oxide-fluorine reaction. The emission spectrum of the nitric oxide-fluorine flame was photographed. Absorption and emission spectra of nitrosyl fluoride: The absorption spectrum of nitrosyl fluoride in the near UV was studied, and 18 electronic-vibrational bands were found. The reaction of nitric oxide and fluorine is chemiluminescent, even with low temperature reaction conditions. The flame spectrum was continuous and was assigned to a radiative 2-body combination of NO and F.

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
LIGHT-SCATTERING AND VISCOSITY STUDY OF POLY(n-LAURYL METHACRYLATE) IN AN IDEAL SOLVENT, by Hsueh T. Lee and David W. Levi. Aug 60, 56p. 7 refs. Technical rept. FRL TR-1.
Order from LC mi$3.60, ph$9.30 PB 148 303

Poly(n-lauryl methacrylate) was fractionated from benzene solution using isopropanol as the nonsolvent. Phase separation studies were used to estimate the θ temperature in n-amyl alcohol and in isoamyl alcohol. Light-scattering and viscosity measurements were carried out on dilute solutions of the polymers in n-amyl alcohol at 29.5°C (θ temperature). The relation between molecular weight and intrinsic viscosity is compared with that determined in another theta solvent. Studies of the chain dimensions in solution have clarified anomalies that were observed earlier. Unperturbed chain extension of methacrylate ester polymers is discussed. (Author)

Florida State U., Tallahassee.
THE SOLVATION OF ELECTROLYTES IN DIOXANE-WATER MIXTURES, AS DEDUCED FROM THE EFFECT OF SOLVENT CHANGE ON THE STANDARD CHEMICAL POTENTIAL, by George Baughman, Ernest Grunwald, and George Kohnstam. Rept. on [Contract Nonr-988(02)]. [1959] 33p. 29 refs.
AD-226 964.
Order from LC mi$3.00, ph$6.30 PB 150 108

The rate of change of the standard chemical potential with changing mole fraction of water, dF^{o}/dZ_1, was measured in 50.00 wt-% dioxane-water for a variety of electrolytes. Values obtained at 25.00° for $2dF^{o}_{\pm}/dZ_1$ were (in kcal per formula weight): NaOH, -17.6; NaCl, -13.8; KCl, -13.8; $(CH_3)_4NCl$, -13.5; RbCl, -13.2; CsCl, -12.5; LiCl, -11.5; KBr, -11.3; $NaNO_3$, -9.8; KI, -8.5; HCl, -7.9; sodium naphthalenesulfonate (β), -4.5; $NaClO_4$, -4.0; $(C_6H_5)_4PCl$, +0.2; $HClO_4$, +0.6; $NaB(C_6H_5)_4$, +15.4. Qualitatively, the positive values mean that these electrolytes are stabilized by addition of dioxane, in spite of the decreasing dielectric constant. Thermodynamic expressions were derived which relate the formal, experimental quantities, F^{o} and dF^{o}/aZ_1, for a dissolved substance to the corresponding quantities for the actual equilibrium mixture of solvated species. Then, assuming that the Born equation applies to each of the species in the equilibrium mixture, it was shown that these electrolytes are not solvated exclusively by water. More accurate theoretical treatments confirmed this result. Minimum values of the average dioxanation number were estimated for each electrolyte. The values tended to increase in the same order as the experimental values of $2dF^{o}_{\pm}/dZ_1$. Results indicate that dioxane can compete on fairly equal terms with water for the solvation of electrolytes. (Author)

Hull U. (Gt. Brit.).
THE INHIBITION OF THE HYDROGEN-OXYGEN REACTION BY METHANE, by R. R. Baldwin, D. Booth and others. Rept. on Contract AF 61(052)62. [1960] 29p. 24 refs. AFOSR-TN-60-298.
Order from LC mi$2.70, ph$4.80 PB 150 039

A preliminary study of the effect of a range of higher hydrocarbons on the second limit of the $H_2 + O_2$ reaction was made during the course of a war-time investigation. To elucidate the mechanism of inhibition, simpler hydrocarbons were selected and preliminary results with propane and detailed results with ethane have already been reported. With both hydrocarbons, the linear relation between explosion pressure and hydrocarbon mole fraction, obtained with the higher hydrocarbons has been confirmed over a wide range of conditions. With methane, however, the features of the inhibition show a remarkable difference from those of the higher hydrocarbons. This report describes these features in detail, and accounts for the difference between the behavior of methane and the higher hydrocarbons.

[Illinois U., Urbana].
FINAL REPORT, by E. Rabinowitch. Rept. for 1 Oct 51-30 Sep 59 on [Contract Nonr-1834(16)] [1959] 35p. 36 refs.
Order from LC mi$3.00, ph$6.30 PB 149 985

The general aim of the research was to gather information on the properties of chlorophyll and other plant pigment in vitro and in vivo which may be relevant to their function in photosynthesis. A considerable amount of valuable information has been obtained, but the specific nature of the processes involved in the conversion of light into chemical energy in photosynthesis still remains elusive. This applies in particular to the role of transfer and migration of energy among pigment molecules, which has been the central theme of the research. (See also PB 136 764)

Institute de Quimica Fisica (Spain).
ENERGY TRANSFER IN ORGANIC VAPOURS, by A. P. Masiá and M. D. Sonet. Annual technical rept. no. 1, 1 Mar 59-29 Feb 60, on Contract DA 91-591-EUC-1086. [1960] 54p. 23 refs; AD-234 911.
Order from LC mi$3.60, ph$9.30 PB 147 614

The "hot wire" method was used to measure the thermal conductivities of gaseous CCl_4, $CBrF_3$, CBr_2F_2, and CBr_2Cl_2 at different pressures and temperatures. The main part of the apparatus is a conductivity cell consisting of a Pt wire of 0.0376 mm diameter. This cylinder contains the gas under study.

Kent State U., Ohio.
THE MEASUREMENT OF THE PROTON-PROTON SEPARATIONS IN APPROPRIATE HYDRATES BY THE NUCLEAR MAGNETIC RESONANCE TECHNIQUE, by J. W. McGrath and A. A. Silvidi. Final rept. on Contract AF 49(638)168. 27 Aug 60, 31p. 37 refs. AFOSR-TR-60-103.
Order from LC mi$3.00, ph$6.30 PB 150 224

The proton-proton separations in hydrated water in ten compounds have been measured by the Pake method using proton magnetic resonance. The mean value is 1.595 ± 0.003 A with a range in values from 1.56 to 1.61 A. The orientations of the water molecule have been determined for eleven compounds. In every instance the orientation appears to be determined by formation of hydrogen bonds between the water oxygen and the nearest pair of electronegative atoms. In one instance, T_1 for protons in barium bromide monohydrate which is normally very long is sharply reduced. An rf unit for use in NMR spectrometers was designed, built and tested.

Laboratoire Méditerranéen de Recherches Thermodynamiques (France).
RESEARCHES ON THE PHENOMENA OBSERVED WHEN A BODY IS MOVING IN AN IONIZED ATMOSPHERE BY THE METHOD OF THE REVOLVING ARM, by F. Marcel Devienne and A. Roustan. Technical note on Contract AF 61(052)124. July 60, 77p. 3 refs. AFOSR-TN-60-907.
Order from LC mi$4.50, ph$12.30 PB 150 345

The phenomena produced on a body moving in an ionized atmosphere arising in the vicinity of the trajectory of the body were studied by the revolving arm method. Ionization was obtained with a high frequency field produced by an oscillator whose frequency may range between a few and a hundred megacycles. A

pulse generator was used to study the equilibrium phenomena in a rarefied gas. The ionization was measured by means of Langmuir probes, generally plane. A study was made of the ionic current received by a metallic surface in function of the motion speed. The experiment shows that this variation is smaller than the theory points out, since the plates in motion are not quite clean, and the impurities, when charged, produce an electrical potential that tends to repulse the ions. The rise of temperature of an ionized gas was measured by comparing it with a non-ionized gas at the same pressure. Variations of ionic density were produced at the time of the passage of the revolving arm. The measurements show the influence of numerous factors on the perturbation caused by the motion of a body moving in an ionized medium. (Author)

Louisiana State U., Baton Rouge.
DOUBLE LAYER STRUCTURE AND RELAXATION METHODS FOR FAST ELECTRODE PROCESSES. II. FARADAIC IMPEDANCE MEASUREMENTS, by Hiroaki Matsuda. Technical rept. no. 37 on Contract Nonr-330(00). Sep 59, 8p. 6 refs.
Order from LC mi$1.80, ph$1.80 PB 148 867

The elements of the equivalent circuit for the faradaic impedance are derived, due consideration being given to the structure of the double layer in the solution of the boundary value problem. It is shown that the classical theory is applicable but that measured exchange current densities and transfer coefficients must be corrected. The phase angle which is also affected can exceed $\pi/4$ when the reactants are strongly attracted in the diffuse double layer. Comparison is made with a similar treatment for the galvanostatic double pulse method. (Author)

Metallic Surfaces Research Labs., Ltd. Uxbridge, (Gt. Brit.)
THE EFFECT OF HIGH FREQUENCY HEATING ON THE DIFFUSION PROPERTIES OF ONE METAL INTO ANOTHER, by R. L. Samuel and J. D. Samuel. Annual technical rept. no. 1, 1 Apr 59-1 Apr 60, on Contract DA 91-591-EUC-1094. 10 Apr 60, 48p.
Order from LC mi$3.30, ph$7.80 PB 149 427

Further tests in confirmation of methods established in the previous period or utilizing new techniques have been carried out on the systems chromium-iron and chromium molybdenum. Solid-solid diffusion of chromium into iron has been studied on cylindrical specimens chromium-plated prior to the high-frequency diffusion treatment. A temperature range of 900°C to 1200°C has been covered and the results of systematic investigation confirm broadly that the rate of diffusion of chromium into Armco iron is accelerated by a factor of up to x 10 as compared to conventional methods of heating. Gas-solid diffusion of chromium into iron has been investigated by two methods. One, referred to as the "test tube" method, where the reacting gas is generated "in situ" has given variable results ranging from low diffusion rates to near-maximum rates. These results are discussed and some explanations are advanced to account for the variations observed. The other gas-solid diffusion method relies on the passage of chromium halide in vapor form around the iron specimen. The method of frequency measurement and a discussion on temperature control are given. The general conclusions are that all methods, correctly applied, give results which are broadly equivalent. Three general lines of explanation are suggested to account for the accelerated diffusion observed.

Naval Ordnance Lab., White Oak, Md.
A KINETIC STUDY OF THE LEAD-THIOUREA REACTION, by Marriner K. Norr. 15 June 58, 39p. 6 refs. NAVORD rept. 6168; AD-214 823.
Order from LC mi$3.00, ph$6.30 PB 147 566

A study of the reaction between lead nitrate, thiourea, and sodium hydroxide is given. The reaction was followed by analyzing for lead and total hydroxide. The ratio of sodium hydroxide to lead nitrate consumed during the reaction was found to be 2.0, within the experimental error. The reaction orders with respect to hydroxide and biplumbite ions vary with time: the former initially being zero and rising to one or two, the latter initially being 2.4 and falling to 1.25 ± 0.03. The reaction apparently is autocatalyzed by lead sulfide. (Author)

North Carolina U., Chapel Hill.
CHRONOPOTENTIOMETRY WITH CURRENT REVERSAL, by Richard M. King and Charles N. Reilley. Rept. on Contract AF 49(638)333. 16 Mar 60, 15p. 5 refs. UNC-Chem. no. 4-CNR; AFOSR-TN-60-766.
Order from LC mi$2.40, ph$3.30 PB 150 121

The transition time ratios for chronopotentiometry with current reversal are derived for the case in which the product of the forward electrochemical reaction decomposes immediately and irreversibly to two or more species which are not electrochemically active at the potential of the forward reaction but which do react consecutively following current reversal. The usual assumptions of semi-infinite linear diffusion control of mass transport are made. The derived results are found to be in good agreement with the experimental results of Geske. (Author)

Pennsylvania U., Philadelphia.
LOW TEMPERATURE IMPURITY CONDUCTION IN n-TYPE SILICON, by Kenneth Atkins, Robert Donovan, and Roger Walmsley. Technical rept. no. 1 on Contract Nonr-551(28). June 59, 43p. 41 refs.
Order from LC mi$3.30, ph$7.80 PB 147 889

This thesis describes measurements made on specially selected silicon samples to investigate the phenomenon of impurity conduction at low temperatures.

Phillips Petroleum Co., Bartlesville, Okla.
A CALORIMETRIC STUDY OF TRAPPED RADICALS PRODUCED BY GAMMA RADIATION, by Raymond L. Arnett, Eugene D. Guth, and Julius R. Berreth. Rept. on Contract AF 49(638)45. Sep 59, 49p. 20 refs. Research Div. rept. no. 2574-60R; AFOSR-TN-59-894; AD-235 427.
Order from LC mi$3.30, ph$7.80 PB 149 002

Several pure gases in the crystalline state (ammonia, methane, nitrogen, argon) and a glass of ammonia, water, acetone, have been irradiated in a gamma field. The amounts of energy stored in the solids are determined by calorimetry. A description is given of the calorimeter and experimental techniques.

Polytechnic Inst. of Brooklyn, N. Y.
COMPLEX CHEMICAL EQUILIBRIA BY MINIMIZING FREE ENERGY, by Leonard M. Naphtali. Rept. on Contract AF 49(638)165. Jan 60, 8p. 1 ref. AFOSR-TN-60-228; PRL-60-1; AD-233 497.
Order from LC mi$1.80, ph$1.80 PB 148 998

A technique is described for computing complex chemical equilibria by the minimization of free energy without utilizing the ideal gas assumption. An equilibrium in a system of 10 components was computed in 20 sec as a Fortran II subroutine with the IBM 704.

Princeton U., N. J.
NON-LINEAR PRESSURE OSCILLATIONS IN A COMBUSTION FIELD, by Gerald Rosen. Rept. on Project Squid, Contract Nonr-1858(25). Oct 59, 11p. 6 refs. Technical rept. PR-98-P; AD-227 730.
Order from LC mi$2.40, ph$3.30 PB 149 493

The unsteady combustion of liquid propellant droplets entrained in a burned gas flow is studied in terms of an idealized mathematical model. The model is used to derive an associated equation for non-linear pressure oscillations. Two necessary and sufficient conditions for unstable oscillations follow from a discussion of this equation. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
FUEL CELL SYSTEMS, by John E. McCormick. July 60, 20p. 4 refs. RADC TN-60-118.
Order from OTS $0.50 PB 161 972

This report discusses the thermodynamics of fuel cells, describes six different types of cells that have been proven feasible, and lists the advantages and limitations of these six types of cells. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE MEASUREMENTS OF THE VAPOR PRESSURE OF ATOMIC SPECIES FROM SPECTROPHOTOMETRIC MEASUREMENTS OF THE ABSORPTION OF THE RESONANCE LINES. IV. STANDARD ENTHALPY OF FORMATION OF SILICON CARBIDE, AND OSCILLATOR STRENGTH OF THE SILICON 2516 LINE, by G. L. Vidale. Rept. on Contract AF 04(647)269. July 60, 44p. 21 refs. Technical Information Series R60SD333. AD-239 281.
Order from LC mi$3.30, ph$7.80 PB 148 878

Spectrophotometric measurements of the absorption of the Si_{2516} resonance line were made of the equilibrium vapor over silicon metal and over silicon carbide, utilizing a hollow cathode discharge tube source previously described to generate a thin resonance line. From the ratio of the pressure of silicon atoms over silicon and over SiC, the standard free energy of formation was computed at 1700°K. The value of the standard heat of formation was then obtained with the aid of the known entropies and heats of warming of the various compounds.

Technical U., Vienna (Austria).
THE BEHAVIOR OF STREAMING AEROSOLS AND THEIR INTERACTION WITH ADSORBING SURFACES, by Alfred Dobrowsky. Final technical rept. for 1 Dec 59-31 Jan 60 on Contract DA 91-591-EUC-1349. 28 Feb 60, 26p. AD-238 720.
Order from LC mi$2.70, ph$4.80 PB 149 433

Functional correlation between filter mass, filter length, filter cross-section area, streaming velocity, pressure drop and filter collection efficiency are investigated on aerosol filters made of wadding, cellulose acetate and wood pulp fibers. The experimental equipment is described. The method is shown for getting experimental data and formulas, to facilitate further studies on this subject.

Tiltman Langley, Ltd. (Gt. Brit.)
TRACER STUDIES OF MIXING IN THE WAKE OF FLAME HOLDERS, by D. B. Spalding. Technical (scientific) note no. 2 on Contract AF 61(514)1213. 30 Nov 59, 111p. 3 refs. AFOSR-TN-60-1004.
Order from LC mi$6.00, ph$18.30 PB 150 359

The wake regions of four axially-symmetrical flameholders have been studied by the injection of a tracer (argon) at one location and the analysis of the tracer concentration at a second location. Both injection and sampling locations were varied so as to provide comprehensive description of mixing patterns in terms of influence coefficients, surveys being carried out when the gas stream was pure air (cold flow) and when the gas stream was a propane-air mixture burning behind the baffle (hot-flow). The influence coefficients were used to enable predictions to be made of the flameholding characteristics of the baffles, in terms of their dimensionless "chemical loading factor" for extinction. It was demonstrated that the values of the influence coefficients, and the sizes of the recirculation zones, were appreciably larger for the hot-flow than for the cold. Loading factors predicted from the hot-flow influence coefficients are therefore an order of magnitude greater than those based on the cold-flow coefficients. (Author).

Western Reserve U., Cleveland, Ohio.
THE OXYGEN ELECTRODE ON CARBON SURFACES, by M. O. Davies, Milton Clark and others. Technical rept. no. 11 on Contract Nonr-2391(00). 15 Nov 59, 108p. 37 refs. AD-237 103.
Order from LC mi$5.70, ph$16.80 PB 148 070

Anodic and cathodic polarization measurements and differential capacitance measurements have been made by interrupter techniques for the oxygen-hydrogen peroxide couple in alkaline solutions with carbon electrodes of the semi-lyophobic type. The results of these measurements have been compared with the surface area, pore distribution, and resistance for a large number of active carbons with different physical properties from various manufacturers. Surface areas and pore distributions have been determined by gas adsorption and desorption methods for both the original carbon and the carbon after incorporation into the electrodes. The polarization has been found to correlate particularly with that portion of the pore distribution

corresponding to radii in the range 4 x 10^{-7} to 2 x 10^{-6}cm and to show little correlation with micro pores with radii of 10^{-7} cm. or less. Indications are that the electrolyte does not penetrate into the micro pore structure. The results of this investigation should prove useful in applied work involving the oxygen cathode on carbon electrodes. (Author)

EARTH SCIENCES

Climatology and Meteorology

Air Force Cambridge Research Center, Bedford Mass.
CONTRIBUTIONS TO SATELLITE METEOROLOGY, by William K. Widger, Jr. June 60, 272p. 77 refs. GRD Research Notes no. 36; AFCRC-TN-60-427.
Order from LC mi$11.10, ph$42.60 PB 150 161

This report discusses: a concept of a meteorological system; applications of meteorological satellites; studies of large-scale cloudiness in the Northern Hemisphere; cloud patterns as seen from altitudes of 250-850 mi; the possibility of measuring cloud velocities from a satellite; a system for the meteorological use of satellite television observations; a photogrammetric method of obtaining the camera axis and its application in determining the time of photos taken from a space vehicle; synoptic-scale radiation processes; studies of atmospheric radiation as observed from satellites; a preliminary investigation of the nature of the infrared view of the earth's atmosphere from a satellite; satellite observations of infrared radiation; detection of ozone amounts from satellite measurements; and a generalized, schematic flow chart for the reduction and processing of satellite meteorological data. (Author)

Air Weather Service, Scott AFB, Ill.
USE OF ASYNOPTIC DATA IN ANALYSIS AND FORECASTING. 11 Mar 60, 30p. 1 ref. AWSM-105-10.
Order from LC mi$2.70, ph$4.80 PB 147 788

Asynoptic data are defined and the importance of utilizing them is stressed. A variety of feasible procedures for plotting, displaying, and analyzing asynoptic reports are illustrated for reconnaissance data, aireps, upper-air soundings, and surface data. Applications of these forecasting, briefing, and met watch are discussed.

Allied Research Associates, Inc. [Cambridge,Mass.]
THE DETECTION BY CPS-9 RADAR AND SHORT RANGE FORECASTING OF SEVERE AND VERY SEVERE THUNDERSTORMS, by Charles R. Shackford. Scientific rept. no. 5 on Contract AF 19(604)5204. 31 Dec 59, 20p. 9 refs. AFCRC-TN-59-660; AD-234 146.
Order from LC mi$2.40, ph$3.30 PB 147 875

The discovery exists that an important radar characteristic of severe and very severe thunderstorms is the reflectivity maximum at levels above 10,000 ft. As a result, a new operational technique was found necessary by which the reflectivity at various levels aloft of the most intense core of a thunderstorm can be quickly determined, and a practical method for doing this is described. The reflectivity profile of an echo can be obtained in 3 min or less and the values at 3 significant levels can be compared for forecast purposes with standard values associated in the past in New England with severe and very severe storms - i.e., storms which may possibly or are likely to produce tornadoes. The method also makes it possible to obtain more frequent reflectivity profile measurements, a very important consideration to meteorological research. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
THE COMPUTATION OF RAWINSONDE FLIGHTS BY GENERAL PURPOSE AUTOMATIC COMPUTERS, by Abraham Arnold and Marvin J. Lowenthal. 15 Oct 59, 25p. 8 refs. USASRDL Technical rept. 2063; AD-227 098.
Order from LC mi$2.70, ph$4.80 PB 147 825

The computation required for a rawinsonde flight is presented. Separate equations are given so that each element of meteorological information may be computed from the output data of Rawin Set AN/GMD-1( ). The equations are then programmed for a general purpose automatic computer which computes the temperature, humidity, height, and wind values from the raw data. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
HYGROTHERMOGRAPH SET AN/TMQ-10 ( ), by Joseph A. Siderman and Edward Lieblein. 1 June 59, 37p. USASRDL Technical rept. 2039; AD-219 317.
Order from LC mi$3.00, ph$6.30 PB 147 820

Results indicate that a satisfactory, low-cost indicator and indicator-recorder with medium accuracy can be

made available. Temperature elements that are accurate and reliable in the desired operating range are available for use with these models. At the present time, however, there are no humidity elements that are suitable for the intended application. Difficulties with existing humidity elements are saturation, short life resulting in high replacement rates, poor repeatability, nonlinear characteristics, poor accuracy, and poor response at low temperatures. A satisfactory humidity element must be developed before further development of the AN/TMQ-10( ) system can be continued. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
A SIMPLE THUNDERSTORM WARNING DEVICE, by Heinz W. Kasemir. 15 June 59, 12p. USASRDL Technical rept. 2046; AD-219 318.
Order from LC mi$2.40, ph$3.30 PB 147 823

The first model of a thunderstorm warning device, using the dependence of the electrostatic field amplitude of lightning strokes on the distance to record the approach of a thunderstorm, is described. A warning bell or light can be set to give an alarm if the approaching thunderstorm underpasses a given distance which can be chosen between 10 and 150 miles. A plus-or-minus log recorder characteristic is applied to cover the wide variation of the field amplitude without range switching. The instrument is simple and inexpensive, and the maintenance is kept to a minimum. (Author)

General Mills, Inc., Minneapolis, Minn.
THE REVERSAL OF STRATOSPHERIC WINDS OVER NORTH AMERICA, by Arthur D. Belmont. Scientific rept. no. 1 on Contract AF 19(604)6618. 22 June 60, 89p. 18 refs. GMI rept. no. 2063; GRD-TN-[60]-490.
Order from LC mi$4.80, ph$13.80 PB 149 309

The prevailing monthly frequency and mean zonal component of easterly and westerly winds from 15 to 30 km are presented in the form of 48 vertical cross sections along the west and east coasts of North America for about five years of record. The tropical easterlies move northward in April and the polar easterlies (existent to some extent all winter) are first prevalent in March. Mid-latitude westerlies separate the two easterly belts in March and April, but in May there is easterly flow at most latitudes above 23 km except near the pole. By July easterlies prevail down to at least 15 km in low latitudes, to 20 km in mid-latitudes, and to 15-17 km at polar latitudes. In August the polar and tropical easterlies are separated and by September the tropical easterlies start retreating to their minimum frequency which is reached apparently in November. (Author)

International Inst. of Meteorology, U. of Stockholm (Sweden).
THE CENTRAL CIRCULATION OF THE ATMOSPHERE IN THE LIGHT OF MORE RECENT INVESTIGATIONS, by Freidrich Defant. Technical (Scientific) note no. 3 on Contract AF 61(514)963. Apr 59, 39p. 35 refs. AFCRC-TN-59-438; AD-234 548.
Order from LC mi$3.00, ph$6.30 PB 148 250

Extensive synoptic studies carried out for selected periods in midwinter 1956 and based on a total careful check of all the radiosonde ascents of the Northern Hemisphere (temperature and wind) allowed to specify the following important basic phenomena inside the General Circulation of the Atmosphere: (1) A threefold subdivision of the tropopause-level by means of two hemispheric tropopause breaks. (2) A classification of the radiosonde ascents giving important information about the baroclinic structure of the atmosphere. (3) Characteristic Polarfront Jetstream and Subtropical Jetstream have to be clearly distinguished from each other. (4) Meandering behaviour of the Subtropical Jetstream in form of suddenly occurring and rapid northward advances of it (subtropical impulses) towards higher latitudes with simultaneous formation of strong and extensive blocking-anticyclones over mid-latitudes. The effect of these on the Polarfront Jet circulation has been demonstrated. These phenomena are discussed in this article.

International Inst. of Meteorology, U. of Stockholm (Sweden)
THE HORIZONTAL AND VERTICAL WIND PROFILES OF THE SUBTROPICAL AND POLAR JET FOR JANUARY 1-7, 1956 AND THE VARIATION OF THE EQUIVALENT BAROTROPIC LEVEL, by Hassam Taba. Technical (Scientific) note no. 4 on Contract AF 61(514)963. 2 July 59, 28p. 6 refs. AFCRC-TN-59-662; AD-234 426.
Order from LC mi$2.70, ph$4.80 PB 147 874

All the available wind information over central, west and north Europe, the Atlantic Ocean, the United States and Canada was studied for a period of seven days, January 1-7, 1956 0300 Z. Mean horizontal and vertical wind profiles were computed at 100 km intervals from the axis of both jets and are discussed. Both on these profiles, the average wind and the equivalent barotropic level is computed. It is shown that the height of the equivalent barotropic level changes as the distance from the axis of the jet varies. The equivalent barotropic level is shown to have a maximum height of 432 mb at the axis of the subtropical jet and a minimum height of 560 at a distance of 1000 km north of the polar jet. An average E. B. L. is computed and is shown to have a height of 505 mb. (Author)

Massachusetts Inst. of Tech., Cambridge.
THE LINEAR PREDICTABILITY OF WEATHER RADAR SIGNALS, by Thomas M. Noel and Aaron Fleisher. Research rept. no. 34 on Weather Radar Research, Contract AF 19(604)5220. June 60, 49p. 9 refs. AFCRC-TN-60-471.
Order from LC mi$3.30, ph$7.80 PB 149 569

A study has been made of the linear predictability of the plane field of radar signals from weather. The results are a description of the quality of the forecasts and their dependence on time and location, of the sources of information and of the eddy structure of precipitation. (Author)

Massachusetts Inst. of Tech., Cambridge.
STUDIES OF THE ATMOSPHERIC GENERAL CIRCULATION, III, by Victor B. Starr. Final rept., 1 Jan 58-31 Dec 59 on General Circulation Project, Contract AF 19(604)2242. Dec 59, 145p. 148 refs.
AFCRC-TR-60-231; AD-237 778.
Order from LC mi$7.20, ph$22.80 PB 148 069

In general terms, the primary concerns were (1) to measure, as far as the existing data permit, the distribution, transfer and conversion of atmospheric energy as a function of wave number, and the hemispheric distribution and transfer of water vapor; and (2) to pursue theoretical studies of the dynamics of the general circulation. (Author)

McGill U. (Canada).
TEMPERATURE AND WIND FREQUENCY TABLES FOR EURASIA. VOL. 3. JULY-SEPTEMBER, by J. N. Rayner. Rept. on Contract DA 19-129-qm-1447. June 60, 209p. Arctic Meteorology Research Group Pub. in Meteorology no. 21.
Order from LC mi$9.30, ph$31.80 PB 150 188

See also PB 148 325

McGill U. (Canada).
TEMPERATURE AND WIND FREQUENCY TABLES FOR EURASIA. VOL. 4. OCTOBER-DECEMBER, by J. N. Rayner. Rept. on Contract DA 19-129-QM-1447. July 60, 209p. Arctic Meteorology Research Group Pub. in Meteorology no. 23.
Order from LC mi$5.70, ph$16.80 PB 150 189

See also PB 150 188

Office of Naval Operations, Washington, D. C.
UPPER WIND STATISTICS CHARTS OF THE NORTHERN HEMISPHERE (300, 200 AND 100 mb LEVELS), by Harold L. Crutcher. Aug 59, 97p. 32 refs.
NAVAER 50-1C-535, Volume II.
Order from OTS $35.00 PB 161 995-2

See also PB 161 995-1

Office of Naval Operations, Washington, D. C.
UPPER WIND STATISTICS CHARTS OF THE NORTHERN HEMISPHERE (850, 700 AND 500 mb LEVELS), by Harold L. Crutcher. Aug 59, 94p. 32 refs.
NAVAER 50-1C-535, Volume I.
Order from OTS $35.00 PB 161 995-1

See also PB 161 995-2

Pennsylvania State U. Mineral Industries Experiment Station, University Park.
TROPOSPHERIC BEHAVIOR ASSOCIATED WITH THE ARCTIC STRATOSPHERIC WARMING PHENOMENON, by Paul R. Julian. Final rept. Pt. 1 on Contract AF 19(604)2190. Dec 59, 111p. 31 refs.
AFCRC-TR-60-240(1).
Order from LC mi$6.00, ph$18.30 PB 149 978

Eight winters, 1952 through 1959, have been investigated in an effort to ascertain tropospheric behavior occurring concurrently with the warming phenomenon. A precise definition of the warming phenomenon was formulated by assuming that the transition of the Canadian Arctic stratosphere from a baroclinic state, with wind speeds at 100mb two to three times those at 500mb, to a near-barotropic state, with the wind speeds at 100 and 500mb almost equal, was the systematic, and annually-recurring event of interest. The large-scale tropospheric behavior was determined by computing pressure-change charts from 30-day mean sea-level charts ending and commencing on the approximate date at which the stratospheric transition began. In all eight winters the sea-level pressure was observed to increase in the Canadian Arctic and decrease in middle latitudes as the transition occurred in the stratosphere. In the four winters with transition dates occurring before 1 March, the increase in arctic pressures was accompanied by a southward movement of the belt of maximum tropospheric westerlies and a pronounced primary index cycle. In the four winters with transition dates in March, the association of the polar pressure rises with an index cycle was not as clear, apparently because positive pressure anomalies at high lititudes existed previous to the transition date. Two winters of data from the Antarctic indicated increases in station pressures over the continent, as the antarctic stratospheric transition occurred.

Quartermaster Research and Engineering Center, Natick, Mass.
THE NIGHTTIME INFLUENCE OF IRRIGATION UPON DESERT HUMIDITIES, by Ivan Bennett and Ronald A. Nelson. July 60, 46p. 13 refs. Technical rept. EP-136.
Order from LC mi$3.30, ph$7.80 PB 150 184

A moderate increase was observed in moisture content of the air in the oasis compared with desert air. The magnitude of the increase was related to the general moisture level of the two prevailing summer air-masses; with dry Pacific air the increase amounted to 15 to 20 F degrees in dewpoint, and with moist air from the Gulf of Mexico it was limited to 5 to 10 F degrees. Similar but smaller differences were noted between moist and dry cropland within the oasis. Advection of moist air from the oasis into the desert could not be sharply delimited quantitatively, but within the first few hundred yards from the edge of the oasis, advection diminished rapidly and seemed barely evident at one mile. Nighttime evaporation and small daytime storage of heat in the oasis soil, contrasted with negligible nighttime evaporation and large heat storage in the soil of the desert, combined to produce minimum daily temperatures 5 to 15 F degrees lower in the oasis than in the adjoining desert. (Author)

Sperry Gyroscope Co., Great Neck, N. Y
A FLIGHT INVESTIGATION OF THE PERFORMANCE OF LOW CEILING/VISIBILITY METEOROLOGICAL EQUIPMENT. Rept. on Contract Cca-29773. Dec 54, 367p. 11 refs. Sperry rept. no. 5245-4059.
Order from LC mi$11.10, ph$56.10 PB 147 958

A flight test program to evaluate operationally the ceilometer-transmissometer system of measuring low ceiling/visibility weather with respect to what the pilot sees from the cockpit during actual weather ILS approaches has been conducted by Sperry Gyroscope Company, Division of The Sperry Corporation, under contract to the Air Navigation Development Board. This project has been conducted under the technical supervision of the Weather Bureau. A general analysis of the flight test data has been performed. The results of this analysis can be used to determine what a pilot will see from the cockpit under observed meteorological and photometric conditions at any airport equipped with the ceilometer-transmissometer system. Information which is not currently available to the pilot, such as the points from which he can first see the ground, the approach lights, and the end of the runway, can be obtained from this system. This information, when used by the pilot, can provide an improvement in approach success and an increase in the safety of instrument approaches. (See also PB 144 114)

Stanford Research Inst., Menlo Park, Calif.
ON METEOROLOGICAL OBJECTIVE ANALYSIS AND MODEL THEORY, by Manfred M. Hall. Final rept. on Contract AF 19(604)5703. July 60, 43p. 2 refs. GRD-TR-60-293; SRI Proj. 2890.
Order from LC mi$3. 30, ph$7. 80 PB 150 173

The development of a system for the analysis of meteorological distributions by the objective treatment of observational data is systematically discussed. The information sources are considered to fall into three categories: (1) data concurrent with the time of the space-distribution analysis, (2) near-past data containing information which may be extrapolated forward in time to the analysis, and (3) well-past data from which come physical laws, statistical and empirical relationships, and subjective, learned, skills. The investigation is limited to considerations of the space-time analysis of the state parameters (pressure, temperature and density) and the wind. The state-parameters are dealt with from the point of view of interrelationships, degree of independence, manners of specification, and transformations. The analysis system is built up on the use of a dynamical-numerical model as data vehicle. The basic system of governing equations is illustrated with density as principal dependent variable of state, and the importance of the horizontal mass-divergence is indicated. The mass-continuity equation is shown to have a near-perfect numerical analogue. The mechanism by which the atmosphere maintains approximate geostrophic balance is considered. Numerical techniques are suggested for possible realization of this wind alignment to a natural degree in the integration without rigid imposition in the model. The propagation of meteorological "noise" and its suppression is also discussed. (Author)

Texas A. and M. Research Foundation, College Station.
DESIGN OF THE MOBILE MICROMETEOROLOGICAL STATIONS EMPLOYED ON PROJECT GREEN GLOW by William H. Clayton and Jerry D. Merryman. Final rept. on Contract AF 19(604)4562. Jan 60, 91p. 3 refs. Reference 60-IT; AFCRC-TR-60-252.
Order from LC mi$5. 40, ph$15. 30 PB 149 570

This paper outlines the design and construction of two mobile micrometeorological stations developed specifically for use on Project Green Glow and for study of the atmospheric boundary layer generally. The two stations are identical with respect to parameters measured and sensors employed, and differ only in the method of data readout. Station 2 (to which the major part of the discussion is devoted) presents the data as sequential parameter values in digitized form on typewritten sheets and punched cards, while Station 1 utilizes the familiar strip chart recorders and electrical counters. (Author)

Texas A. & M. Research Foundation, College Station.
MICROMETEOROLOGICAL DATA PROJECT GREEN GLOW. VOLUME I. WET AND DRY BULB TEMPERATURE, STATION 3, by William H. Clayton. Scientific rept. no. 1 on Contract AF 19 (604)5527. June 60, 700p. Reference no. 60-8D1; GRD-TN-60-489.
Order from LC mi$11. 10, ph$105. 90 PB 150 181

Two mobile micrometeorological stations were employed for the collection of these data. These stations, designated 2 and 3 on the accompanying field map, were equipped for air temperature measurements (wet and dry bulb) at eight levels, wind speed at eight levels, wind direction at one level, soil temperature at seven levels, soil heat flux, insolation, reflected insolation, net radiation, soil moisture, and standard surface observations. Only wet and dry bulb temperature values from Station 3 are given in this report.

Weather Services, Inc., Boston, Mass.
DEVELOPMENT OF A METHOD OF FORECASTING THE OCCURRENCE AND BASE ALTITUDE OF CONTRAIL FORMATION. Scientific rept. on Contract AF 19(604)1961. 20 Jan 60, 47p. AFCRC TN-60-231.
Order from LC mi$3. 30, ph$7. 80 PB 146 466

To forecast the occurrence of contrails, a simple mathematical predicting model was developed. This was based primarily on the shape of the ascent curve. The mathematical problem was one of discriminant analysis, in which a linear combination of three slopes was found, which maximized the ratio of the variability of the resulting combination between the two categories, contrails and no contrails. The discriminant values found for all cases separated well ranging from 85% to 100% correct. In the forecasting of the height of contrail formation, an equation was developed using the prevailing height of the tropopause to indicate approximate height of contrail formation and the height at which the -50C temperature occurred. The data was normalized providing a forecasting method, effective regardless of location. A graph of this equation resulted in a simple method of forecasting contrail height. (Author).

Wisconsin U. [Madison].
AN EXPERIMENT IN STRATIFIED CLIMATOLOGY OF UPPER WINDS, by Walter I. Christensen, Reid A. Bryson, and Charles W. Hutchins. Scientific rept. no. 2 on Contract AF 19(604)5191. Feb 60, 79p. 6 refs. AFCRC-TN-60-201; AD-235 072.
Order from LC mi$4. 50, ph$12. 30 PB 148 252

As an experiment in stratified climatology, a contingency technique is tested for forecasting 300 mb geostrophic winds over a central point in a given area for the month of March. Eight years of data (1950-1957 is incorporated into the forecast scheme and March 1958 is used for verification. Results are compared with other objective and subjective forecast methods with the results of this study comparing favorably with other objective methods but not surpassing the accuracy level of the Joint Numerical Weather Prediction Unit. Simplicity and rapidity of application of this contingency technique is preserved and stressed. It is believed that this method has merit and further research in this area may provide more significant results. (Author)

Wisconsin U. [Madison]
AN EXPERIMENT IN THE INTERPOLATION OF PRESSURE CONTOUR PATTERNS IN AREAS OF MISSING DATA, by James R. Blankenship, Reid A. Bryson, and Lyle H. Horn. Scientific rept. no. 1 on Contract AF 19(604)5191. Feb 60, 55p. 4 refs. AFCRC-TN-60-200; AD-235 071.
Order from LC mi$3.60, ph$9.30 PB 148 251

A method of interpolating the pressure pattern into an area of missing data is studied from adjacent areas of known data. The method is used to describe the known portions of the northern hemispheric 500-mb flow by the use of orthogonal polynomials. This method reduces the 500-mb contour pattern to a mathematical formula, which if converted back to the original map will usually contain 95% of the variance of the original 500-mb chart. By the use of the variable coefficients of the orthogonal polynomials, the values for these same coefficients can be interpolated for the silent area. This study indicates that a silent area chart can be produced by this method with an average accuracy of 88% or greater. The basic premise of this approach is that all weather patterns are themselves globally inter-dependent, therefore, the coefficients of the known area must reflect at least the main conditions in the missing area. The basic data were obtained from the US Navy project AROWA map series. This data, being on IBM cards, made it possible to utilize the IBM 650 electronic computer. (Author)

Wisconsin U., Madison.
HEAT FLUX IN LAKE MENDOTA, by John A. Dutton and Reid A. Bryson. Technical rept. no. 2 on Contract Nonr-1202(07). June 59, 106p. 15 refs.
Order from LC mi$5.70, ph$16.80 PB 150 049

In Chapter I the heat budget of the lake's surface is examined. Starting with a relationship that combines the factors of net radiation, evaporation, transfer of heat to the air, and the change in heat content of the lake, the balance of these factors from month to month are developed. The result is a quantitative understanding of how the heat provided by the sun at the lake's surface is partitioned through various processes, and how this partitioning changes with the season. Chapter II shows quantitatively how the heat which is transferred through the surface of the lake is distributed with depth, and demonstrates the development and decay of thermal structure through the ice-free season of the lake. A well-known method of solving Fourier's heat conduction equation is developed and applied to the lake. The first results of the attempt to relate the observed parameters of the lake to those of the atmosphere are presented in Chapter III. The value of the concept of the lake as an integrator of the climate is shown through the high correlation of lake surface temperatures and the average of air temperatures over periods from one week to a month.

Frost Science

Denver U. [Colo.]
ELASTIC PLATES WITH SIMPLY SUPPORTED STRAIGHT BOUNDARIES, RESTING ON A LIQUID FOUNDATION, by Arnold D. Kerr. Rept. on Bearing Capacity of Floating Ice Sheets, Contract DA 11-190-eng-34. Sep 59, 18p. 14 refs. SIPRE Research rept. 59; AD-237 338.
Order from LC mi$2.40, ph$3.30 PB 149 134

The deflection expression of an infinite plate subjected to a concentrated force is used with the "method of images" to obtain solutions for 6 plates with simply supported edges. The semi-infinite plate, the wedge-shaped plate, and its special case, the rectangular corner plate, are solved in closed form; and the infinite strip, the semi-infinite strip, and the rectangular plate are solved as rapidly convergent series. Behavior under a concentrated force is studied in more detail for the semi-infinite plate and the rectangular corner plate. Relationships for obtaining bending moments, shear forces and reaction distributions as well as derivatives of the kei-function with respect to r and θ are given. (Author)

Denver U. [Colo.]
PLASTIC DEFORMATION OF FLOATING ICE PLATES SUBJECTED TO STATIC LOADS, by Arnold D. Kerr. Rept. on Bearing Capacity of Floating Ice Sheets, Contract DA 11-190-eng-34. Sep 59, 15p. 12 refs. SIPRE Research rept. 57; AD-237 533.
Order from LC mi$2.40, ph$3.30 PB 149 132

The problem is analyzed mathematically for decreasing and increasing rates of deflection. The analysis is based on the assumptions that for decreasing rates of deflection the floating ice plate will deform under lateral load without failure until the weight of the displaced water is equal to that of the load, and that for increasing rates, deflection increases until the ice plate collapses under and near the load. It is also suggested that the total deflection at a certain time is the result of the elastic deflection surface and the plastic deflection due to shear only, the shear forces obeying Newton's law of viscosity. Deflection equations for plastic deflection due to shear are derived for an infinite plate subjected to a line load, an infinite plate subjected to a concentrated force (axially symmetrical flexure), and an infinite plate subjected to uniform circular load. Equations for elastic deflection to be added to the plastic deflection due to shear are suggested. According to the statements and assumptions made and the results obtained, the total system of an ice plate resting on a liquid base can be considered as a Kelvin body for the case of decreasing rates of deflection. (Author)

Geodesy

Aeronautical Chart and Information Center, St. Louis, Mo.
GEODETIC DISTANCE AND AZIMUTH COMPUTATIONS FOR LINES OVER 500 MILES. Rev. Dec 59, 90p. 27 refs. ACIC Technical rept. no. 80.
Order from OTS $2.25 PB 161 994

This is the third and final report of a series containing the results of a geodetic investigation of existing formulae suitable for computing geodetic distance and azimuth of the basic geodetic curves; the geodesic, normal section and great elliptic arc. It recommends those formulae not too complex for general use and adaptable to desk calculator and electronic digital computer. Eighteen equations were evaluated; seven for the great elliptic; seven for the geodesic and four for the normal section. The accuracy criteria for this report are set at 1:100,000 in length and one second of arc in azimuth. (Author). (See also PB 124 647, PB 131 980).

Aeronautical Chart and Information Center, St. Louis, Mo.
A PHOTOCHEMICAL PROCESS FOR PREPARATION OF MASTER TERRAIN MODELS, Aug 60, 13p. 7 refs. ACIC Interim Technical rept. no. 91.
Order from OTS $0.50 PB 161 993

The primary purpose of this report is to present a standardized procedure for rapidly and economically preparing master terrain model surfaces by photomechanical methods to support production of shaded relief masters now being prepared by artist airbrush and hand rendering. Further processing of these products can afford users wide selection of related topographic items. In this procedure, white light is admitted through a variable-toned transparency directly into a particular sentized liquid plastic (initially formulated and patented by Haloid Xerox, Inc.) for a predetermined exposure. Exposure of this projected image will produce a hardened three-dimensional surface of the plastic, thus reducing conventional terrain model making to a more simplified photomechanical operation. Reproduction of this master with select molding media will provide various photographic and thermo-formed by-products. The process described here does not intend to furnish all-purpose solutions to user requirements, but does afford rapid means of effectively portraying terrain detail in 3-dimensional form and provides stimulas to continue investigation toward improving photomechanical techniques and products relating to terrain identification and simulated effects useful to analysis, training, and briefing. (Author).

Naval Photographic Interpretation Center, Washington, D. C.
STUDY OF VEGETATION AND TERRAIN CONDITIONS FROM AERIAL PHOTOGRAPHY, by P. E. Truesdell. Final rept. on Proj. TED PIC PH-4747.4. May 59, 81p. PIC rept. 207/59-U.
Order from LC mi$4.80, ph$13.80 PB 150 786

This report released for sale to the public 11 Oct 60.

A study was conducted concerning the interpretation of vegetation and associated terrain conditions from aerial photography obtained from a selected area in the Northern Hemisphere. The study consisted of a field trip to the area to be investigated and laboratory work with the aerial photography as a basis for determining the recognition characteristics of the vegetation observed on the field trip. It is concluded that, the study will be an aid to the photo interpreter in becoming familiar with certain vegetation types and their associated terrain conditions. (Author)

Geology

American Geographical Society, New York.
GLACIAL GEOLOGY OF THE LAGUNA SAN RAFAEL AREA, by Ernest H. Muller. Rept. on American Geographical Society Southern Chile Expedition, 1959, Contract Nonr-641(04). Oct 59, 35p. 22 refs. AD-227 472.
Order from LC mi$3.00, ph$6.30 PB 149 864

Contents:
Pre-Tempanos glaciation
Tempanos glaciation
  Topographic expression
  Exposures in the banks of Rio Tempanos, near Otqui, and in shore-bluffs of Laguna San Rafael
  Correlative moraines of adjacent glaciers
Oscillations of recent centuries
  Recent moraines
  Modern outwash plain
  Stratigraphic evidence
  Historic evidence of recent fluctuations
San Rafael glacier in 1959
  Ice cave observations
  Moraine deposition

Instituto de Edafologia y Fisiologiya Vegetal, Madrid (Spain).
STUDY OF THE SOILS OF THE EBRO VALLEY. I. PROVINCES OF LOGRONO AND NAVARRA, by J. M. Albareda, F. Monturiol and others. Final technical rept. for 1 Mar 59-30 Feb 60 on Contract DA 91-591-EUC-1085. [1960] 126p. 25 refs. AD-235 137.
Order from LC mi$6.30, ph$19.80 PB 147 622

Soil maps were drawn of the provinces of Navarra and Logrono with special consideration of the study of profiles in the terrain. The maps and a study of the geological characteristics of both provinces allowed the establishment of 11 different soil series, in some of which the lithosoil stage was also mapped. Four distinct sectors corresponding to 4 different natural regions, with their different reliefs and patterns were distinguished. The types of climate which correspond to these 4 natural regions were studied supported by climatological data. The geological history of the Ebro Valley, the main mineral resources, and the terrain belonging to different ages and stories are described; the lithology of the different materials was analyzed. Studies were made of spontaneous vegetation, in which the main constitutive species of the xerophytic thicket and humid woodland, hydrography,

and agrarian economy are examined. The mineralogical study of sands and clays was undertaken of the 11 soil series. Study of clays revealed the constancy of the illite-kaolinite association. Different Fe forms, particularly geothite, were very abundant in every profile. The results of the mineralogical analysis of the heavy fractions indicated that very resistant species such as tourmaline, zircon, and rutile predominate. Opaque grains were very abundant.

Oceanography

Office of Naval Research, Washington, D. C.
THE NEXT TEN YEARS IN OCENAOGRAPHY (A SURVEY OF THE GROWTH POTENTIAL TO EXISTING INSTITUTIONS) by Gordon G. Lill, A. E. Maxwell, and F. D. Jennings. 1 Jan 59, 33p. 5 refs.
Order from LC mi$3.00, ph$6.30 PB 150 586

This report released for sale to the public 11 Oct 60.

Several groups, including the Office of Naval Operations, members of Congress and the Committee on Oceanography of the National Academy of Sciences - National Research Council, have requested that a broad long range program of oceanographic research be formulatec to present the current status and the future requirements that are necessary to maintain the needs of the country. This document has been prepared as an essential part of that research.

Texas A. and M. Coll., College Station.
DATA REPORT FOR TWO IGY CRUISES, by Hugh J. McLellan. Rept. on Contract N7onr-48702. Apr 59, 117p. 2 refs. Reference 59-15D; AD-220 390.
Order from LC mi$6.00, ph$18.30 PB 148 270

Cruise 58-H1 was carried out March 23 to April 3, 1958. A line of stations to a maximum depth of 3500 meters was occupied along the 94°30' W meridian crossing the Gulf of Mexico from North to South. The locations of stations are shown on the track chart. Fourteen hydrographic stations were occupied, 4 bottom cores taken and 144 B. T. observations made. Cruise 58-H4 May 13 to June 29, 1958. The track followed and the positions at which observations were made are shown. In all 90 hydrographic stations were occupied. Twenty-eight bottom cores were taken and 410 B. T. observations made.

Woods Hole Oceanographic Institution, Mass.
OCEANOGRAPHIC DATA FROM MEDITERRANEAN SEA, RED SEA, GULF OF ADEN, AND INDIAN OCEAN; ATLANTIS CRUISE 242 FOR THE INTERNATIONAL GEOPHYSICAL YEAR 1957-58, by A. Conrad Neumann and Dana Densmore. Rept. on Contract Nonr-2196(00). Dec 59, 44p. 9 refs. Reference no. 60-2.
Order from LC mi$3.30, ph$7.80 PB 146 999

The data of 51 hydrographic stations plus a list of surface salinity and temperature values are presented.

Physics of the Atmosphere

Air Force Special Weapons Center, Kirtland AFB, N. Mex.
COMPOSITION OF RADIATION TRAPPED IN THE GEOMAGNETIC FIELD AT ALTITUDES UP TO 1,000 KILOMETERS, by Francis E. Holly and Richard G. Johnson (Lockheed Missile and Space Research Lab.) Mar 59, 18p. 5 refs. AFSWC-TN-59-15; AD-216 354.
Order from LC mi$2.40, ph$3.30 PB 147 815

An instrument package containing 8 Geiger tubes was flown at an altitude of 1,000 km in a region of the lower Van Allen radiation belt. Five different thicknesses of absorber were used to obtain a range spectrum of penetrating particles. The radiation penetrating 30 $\frac{mg}{cm^2}$ Al absorber ($>$ 160 kev electrons) was determined, by magnetic selection, to be predominantly electrons. Ninety-nine percent of the flux in the measurement energy range (30 kev to 4 Mev for electrons) would not penetrate the same absorber thickness as a 600 kev electron. A trapped high energy component was observed. (Author)

Avco Corp., Wilmington, Mass.
IONOSPHERIC DISTURBANCES FOLLOWING A SOLAR FLARE, by G. E. Hill. Scientific rept. no. 6 on Research Concerning Forecasting Anomalous Propagation at High Latitudes, Contract AF 19(604)4092. Aug 60, 46p. 14 refs. Technical rept. RAD-TR-60-22; AFCRC-TN-60-598.
Order from LC mi$3.30, ph$7.80 PB 150 341

Northern Hemispheric charts of f min, foEs, and foF2 at intervals of 3 hours have been constructed for the disturbed period from 12 through 15 September 1957. Enhanced f min values have been found over the polar cap on 12 September. By the time of the sudden commencement (SC) of geomagnetic activity (0046Z, 13 September) the f min disturbance spread outward to the auroral zone. Following the SC, the f min disturbance formed in an elliptically shaped ring around the earth while the polar cap f min disturbance dissipated. The elliptical ring (coincident with constant dip lines) then expanded southward, and by 0900Z, the approximate time of the main phase, the f min ring disturbance reached a constant dip of about 72 degrees. Just to the north of this ring, in Canada, a crescent-shaped sporadic E disturbance developed. It also moved southward. Subsequently, a band of sporadic E appeared over northern Asia. The foF2 disturbance began about the time of the SC and lasted about 36 hours. On the basis of the f min and foEs patterns, it is concluded that prior to the SC, solar corpuscles impinge on the lower ionosphere directly from outside of the earth's "magnetosphere". The post-SC f min and foEs disturbances is attributed to trapped radiation drifting at relatively low altitudes (below about 2000 km). The southward expansion of the disturbances is a result of the strengthening of the solar stream. (Author).

Ballistic Research Labs., Aberdeen Proving Ground, Md.

INSTRUMENTATION USED FOR IONOSPHERE ELECTRON DENSITY MEASUREMENTS, by William J. Cruickshank. May 60, 20p. 7 refs. Technical note no. 1317; AD-239 903.
Order from LC mi$2.40, ph$3.30 PB 150 093

The technique employed for the measurement of ionospheric electron densities through study of differential propagation effects on two-phase coherent frequencies broadcast from high altitudes is discussed. A brief description of the stable airborne transmitters and of the rocket vehicle designated "Strongarm" which was used in an initial experiment to carry the airborne transmitters to an altitude of 1,000 miles is presented. The very narrow band receivers and recording equipment needed to provide data reception and information separation are discussed. A summary is given of the results of the two "Strongarm" rockets that have been fired, and the schedule of future experiments is outlined. (Author)

Electromagnetic Research Corp., Washington, D. C.

DETERMINATION OF IONOSPHERE PARAMETERS BY MEANS OF A SATELLITE ANTENNA-TYPE PROBE, by W. W. Zachary, E. A. Wolff, and M. Katzin. Scientific rept. no. 1 on Contract AF 19(604)6656. 30 June 60, 57p. 11 refs. Rept. no. CRC-6656-1; GRD-TN-60-492.
Order from LC mi$3.60, ph$9.30 PB 149 844

A spherical antenna-type probe for determining the parameters of the ionosphere is described. This consists of a main slot around which are disposed pairs of small orthogonal slots. By applying a driving voltage to the main slot and measuring the input impedance as well as the voltages induced in the orthogonal slots, the ionization density, collision frequency, and vector earth's magnetic field may be determined. These are local values since the reaction of the medium on the probe is effectively limited to distances of the order of less than a wavelength. As a preliminary to the main analysis, the input admittance of a slotted plane antenna in a magneto-ionic medium is analyzed. The solution is obtained in a form suitable for numerical evaluation. Measurement systems for the determination of the quantities necessary to evaluate the parameters of the ionized medium are considered. Three systems are shown and their relative advantages and disadvantages are outlined. A suitable measurement system appears to be quite feasible of realization. (Author)

Institute of Geophysics, U. of California, Los Angeles.

THEORETICAL AND LABORATORY STUDIES IN CHEMICAL AERONOMY, by William J. Schade. Final rept. for 1 Mar 57-30 Apr 60 on Contract AF 19(604)2144. Apr 60, 14p. 8 refs. AFCRC-TR-60-241.
Order from LC mi$2.40, ph$3.30 PB 149 535

A new portable high-speed ultraviolet spectrograph is described. The specifications of the instrument are given. A laboratory source for the study of some aeronomic chemical reactions is considered. This source is seen to be useful for studying the recombination processes of atomic oxygen. (Author)

International Inst. of Meteorology, U. of Stockholm (Sweden).

INVESTIGATIONS ON THE DETAILED STRUCTURE OF THE ATMOSPHERE IN NORTHERN HEMISPHERE MID-SUMMER (15-20 JULY 1957, IGY-DATA) by Friedrich Defant. Technical (scientific) note no. 5 on Contract AF 61(514)963. 1 Sep 59, 126p. AFCRC-TN-59-664; AD-234 430.
Order from LC mi$6.30, ph$19.80 PB 147 873

Contents:

Synoptic situation (15-20 July 1957); worldwide check on the summer tropopause-level and on the level of maximum wind; position of polarfront jet and subtropical jet; the summer-polarfront

Presentation of mean vertical temperature distributions in each of the special selected atmospheric spaces (polar, midlatitude, tropical, and in the vicinity of the summer subtropical jet) and a comparison of these average distributions with that obtained for mid-winter periods.

Presentation of frequency distributions of temperature for various isobaric surfaces in each of the atmospheric space selected in order to demonstrate the conservative character of the average temperature in each space; proof for the existence of 3 principal air masses as opposed to system of 2 principal masses (polar - tropical)

Dependence of the summer temperature on latitude in various levels of the naturally subdivided atmospheric spaces

Presentation of mean meridional cross-sections of the actual and the potential temperature for northern hemisphere summer

Average values of the vertical gradient of potential temperature in each of the atmospheric spaces; presentation and discussion of a mean meridional cross-section of the static stability for northern hemisphere summer

Maryland U., College Park.

THE LATITUDE AND ALTITUDE DISTRIBUTION OF GEOMAGNETICALLY TRAPPED PROTONS, by S. F. Singer. Rept. on Contract AF 49(638)530. 17 June 60, 8p. 12 refs. AFOSR-[TN]-60-747.
Order from LC mi$1.80, ph$1.80 PB 149 883

Massachusetts Inst. of Tech., Cambridge.

ENERGY TRANSFORMATION AND VERTICAL FLUX PROCESSES OVER THE NORTHERN HEMISPHERE, by Clayton E. Jensen. Scientific rept. no. 1 on Planetary Circulations Project, Contract AF 19(604)6108. Aug 60, 260p. 39 refs. AFCRC-TN-60-460.
Order from LC mi$11.10, ph$39.60 PB 149 971

The integrals in the mechanical energy equation representing energy transformation and vertical flux processes have been individually evaluated as a function of selected pressure layers and as a function of a broad division of eddies in the atmosphere over the Northern Hemisphere for January and April 1958. Values of the vertical divergence of energy and measures of the energy transformation process have been introduced into the energy balance equation leaving a residual which approximates the order of magnitude of the dissipative action within the particular region of the atmosphere being sampled. (Author)

Ohio State U. Research Foundation, Columbus.
INFRARED STUDIES OF THE ATMOSPHERE, by J. W. Birkeland, R. L. Bowman and others. Final rept. for 1 Sep 57-30 Mar 60 on Thermal Radiation Methods of Atmospheric Probing, Contract AF 19(604)2259. Apr 60, 97p. 4 refs. GRD TR-60-285.
Order from LC mi$5.40, ph$15.30 PB 150 163

The results of a two and one-half year program of investigating the atmosphere by infrared techniques are described. Measurements have been made of the abundance of atmospheric carbon monoxide, nitrous oxide, and methane. High-resolution spectra of NH_3 and ND_3 have been analyzed, and methods for the wavelength calibration of infrared spectrometers have been developed. Investigations of the pressure modulation of infrared absorption by gases have been conducted, and a search for the molecule NH_4OH in mixtures of NH_3 and H_2O has been undertaken using infrared techniques. Included in the report are:

Pressure Modulation of Infrared Absorption. I. Entire Vibration-Rotation Bands, by James C. Gilfert and Dudley Williams. Pub. in the Jnl. of the Optical society of America 48:765-769, Nov 58.

The Abundance of Atmospheric Carbon Monoxide above Columbus, Ohio, by J. H. Shaw. Pub. in The Astrophysical Jnl. 128:428-440, Sep 58.

Abundance of Nitrous Oxide in Ground-Level Air, by J. W. Birkeland and J. H. Shaw. Pub. in the Jnl. of the Optical Society of America 49:637-638, June 59.

Rensselaer Polytechnic Inst., Troy, N. Y.
UTILIZATION OF ENERGY OF THE UPPER ATMOSPHERE, by P. Harteck, R. R. Reeves, Jr., and G. G. Mannella. Final technical rept. on Contract AF 19(604)2205. 8 Apr 60, 35p. 14 refs. AFCRC-TR-60-264.
Order from LC mi$3.00, ph$6.30 PB 149 863

A research program dealing with problems connected with the chemistry of the upper atmosphere has been carried on for three years. The program covered laboratory investigations on chemical reactions and atom chemistry; and the evaluation of the HARE, a vehicle designed to use the energy of recombination of O-atoms as a means of propulsion. In connection with this work, an experiment was carried out on the NRL-52 rocket at White Sands, New Mexico, to measure the O-atom concentration of the upper atmosphere.

ENGINEERING

Aeronautical Engineering

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
INVESTIGATION OF LARGE EXPANSION DIFFUSERS FOR MINIMUM ROTOR AREA, by Jean F. Duvivier and Robert B. McCallum. Rept. on Contract DA 44-177-tc-486. Nov 59, 102p. 56 refs. Technical rept. 81-1; AD-233 528.
Order from LC mi$5.70, ph$16.80 PB 147 831

Means of reducing the size of a ducted fan for a given thrust and exit area were investigated. Short diffusers with expansion ratios from 4 to 8.71, were studied in two-dimensional and three-dimensional flow downstream of an operating fan with several wall shapes; center vanes, boundary layer control by localized suction and air injection, and shaped center bodies were used to control the flow in the diffusers. Various pressure distributions and velocity profiles were measured

Airborne Instruments Lab., Mineola, N. Y.
EVALUATION OF OMNI-BEARING-DISTANCE SYSTEM OF AIR NAVIGATION, by W. R. Rambo, J. S. Pritchard and others. Summary rept. Oct 50, 42p. 7 refs. Rept. no. 540-1.
Order from LC mi$3.30, ph$7.80 PB 147 952

The Omni-Bearing-Distance (OBD) system of air navigation is based on range and bearing information furnished from a preselected single site by a UHF Distance-Measuring Equipment (DME) and a VHF Visual Omnidirectional Range (VOR). The addition of a Course-Line Computer enables flight between any two selected points within the service area of the ground equipments. The principal objective of the evaluation program was to determine the accuracy of the navigation information provided by an OBD facility within its coverage area.

American Machine and Foundry Co., Chicago, Ill.
MODEL TESTS AND STUDIES OF THE PROBLEMS OF DYNAMIC TENSIONS IN AIRCRAFT-ARRESTING GEAR CABLES, by Frank T. Sasaki, Norman F. Eslinger, and Glen L. Neidhardt. Rept. on Contract AF 33(616)5282. Oct 59, 190p. 10 refs. WADC Technical rept. 59-495; AD-237 294.
Order from OTS $3.00 PB 171 007

A one-tenth scale model aircraft arresting gear incorporating a cable tension alleviation device was tested. It is concluded that the analytical method employed is practical and can be used to determine cable behavior in an arresting gear with sufficient accuracy. The theoretical treatment of cable waves as kinks was observed as a realistic approximation from high-speed photography. The tests indicate that the absence of cable hysteresis causes greater travel of the alleviator sheaves. A servo-controlled tension-alleviating device for aircraft-arresting gear systems is shown to be feasible. Controlled movable sheaves are employed, the motion being restrained by a servo-controlled breaking force. The fundamental physical parameters of wire rope are discussed, and the use of titanium or alloys instead of steel is proposed.

Applied Mathematics and Statistics Labs., Stanford U., Calif.
STATISTICAL QUALITY CONTROL IN THE IRAN PROGRAM, by W. G. Ireson. Technical rept. no. 43 on Contract N6onr-25126. 23 Oct 59, 14p. AD-228 271.
Order from LC mi$2.40, ph$3.30 PB 149 502

Armour Research Foundation, Chicago, Ill.
DEVELOPMENT OF AN OZONE ANALYZER FOR USE IN AIRCRAFT, by Joseph F. Roesler and C. R. McCully. Rept. for 1 Apr 58-30 June 60 on Contract AF 19(604)3884, continuation of Contract AF 19(604)1814. June 60, 25p. ARF 3128-12; Final rept.; GRD-TR-60-282.
Order from LC mi$2.70, ph$4.80 PB 149 862

The objective of this program was to develop an instrument to detect 0-100 ppm of ozone for use in aircraft at altitudes up to 80,000 ft. The resulting analyzer detects 0.1 ppm of ozone with an accuracy of 10%. It has a sensitivity of 44 μv/ppm of ozone and a response time of 22-30 sec. Field tests of the ozone analyzer have not only showed that it is practicable, but they have led to additional improvements in sensitivity and stability. The instrument is sensitive to changes in humidity, but a dry ice trap has been successfully employed to remove moisture without removing ozone. Changes in ambient temperature and flow rate have no effect on drift-resistant system.

Armour Research Foundation, Chicago, Ill.
EVALUATION AND ALLOY DEVELOPMENT OF HOT-WORK DIE STEELS FOR STRUCTURAL PURPOSES, by Michael Schneider and John P. Sheehan. Rept. for 15 Apr 58-30 June 59 on Metallic Materials, Contract AF 33(616)5633. May 60, 94p. 32 refs. WADC Technical rept. 59-705.
Order from OTS $2.25 PB 171 008

A program to investigate the tensile properties of three commercial hot-work die steels, Vascojet 1000, Potomac M, and Peerless 56 has been carried out. The results indicate that in sheet form these materials are essentially equivalent and developed the following nominal peak properties when air cooled from 1850°F and double tempered at 1000°F: 295,000 psi ultimate tensile strength; 233,000 psi yield strength at 0.2% offset; and 7% elongation in 2 in. gage length. Approximately 30 experimental alloy steels were melted, in which most of the common alloying elements were investigated to determine their effects on tensile properties. Of these, several developed yield strengths of 280,000-290,000 psi, ultimate tensile strengths of 340,000-360,000 psi and tensile elongatons of 3-5% in 2 in. gage length on sheet material approximately 0.080 in. thick. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn].
SOME COMMENTS CONCERNING THE DEVELOPMENT TRENDS AND GROWTH CHARACTERISTICS OF TURBOJET ENGINES, by Robert E. Smith, Jr. Rept. on ARO, Contract AF 40(600)800. Mar 60, 33p. 3 refs. AEDC TN-60-54.
Order from LC mi$3.00, ph$6.30 PB 149 975

Some of the development trends of the turbojet engine for aircraft application in the United States in terms of changes in overall engine performance and component performance are shown for the period 1943-1958. The changes in performance resulting from changes in basic design and from refinements (growth) of a given design are presented. Only performance of unaugmented engines at military rated power at sea-level static conditions is considered. Performance improvements in American-designed engines are compared with improvements in English-designed engines over the period from 1943 to 1951. (Author)

Avco Corp., Nashville, Tenn.
DESIGN, DEVELOPMENT AND FABRICATION OF A LIGHT WEIGHT AIRFRAME. Monthly progress rept. no. 2 for June 1960 on Contract DA 33-008-ORD-1968. 15 July 60, 88p. This report includes "Light Weight Airframe Stress Analysis", Rept. SR-000-010.
Order from LC mi$4.80, ph$13.80 PB 150 047

Specific problems solved are: (a) the re-design of the weight support structure at Station 43.00 to provide greater rigidity; (b) a thorough study of methods of providing a safety lock for the locking ring at the body break at Station 48.00; and (c) the selection of material and design of the sealing gasket at Station 48.00. (See also PB 149 302)

Avco Corp., Nashville, Tenn.
DESIGN, DEVELOPMENT AND FABRICATION OF A LIGHT WEIGHT AIRFRAME, by A. V. Forte. Monthly progress rept. no. 3, July 60, on Contract DA 33-008-ORD-1968. 15 Aug 60, 31p. 3 refs.
Order from LC mi$3.00, ph$6.30 PB 150 279

The structural arrangement was established based on an aluminum honeycomb construction which design studies had shown best satisfied the optimum requirements of weight, shell stability, aerodynamic smoothness, deflection and strength criteria. Materials were selected for the Airframe design which would meet the service requirement of safety withstanding a 400°F temperature exposure for 5 minutes. The test program which defined the proposed methods for substantiating the structural, environmental and mechanical requirements of the airframe was completed and submitted for approval. (See also PB 150 047).

Battelle Memorial Inst., Columbus, Ohio.
THE EVALUATION OF THE EFFECTS OF VERY LOW TEMPERATURES ON THE PROPERTIES OF AIRCRAFT AND MISSILE METALS, by Leonard P. Rice, James E. Campbell, and Ward F. Simmons. Rept. for 1 May 59-29 Feb 60 on Metallic Materials, Contract AF 33(616)6345. June 60, 61p. WADD TR-60-254.
Order from OTS $1.75 PB 171 016

In the past few years, the use of liquefied gases such as oxygen, nitrogen, hydrogen, and helium has increased enormously in the aircraft and missile industries. There is a great deal of interest in metallic materials to store, transport, or otherwise handle these extremely low-temperature liquids. This investigation presents the tensile and hardness properties of eight different alloys of interest to the aircraft and missile industries at temperatures ranging from -253 C (liquid hydrogen) to room temperature. These alloys are Ti-6Al-4V, Ti-5Al-3Mo-1V, Ti-16V-2.5Al, and B-120VCA (all-beta alloy) titanium alloys; 17-7PH, PH15-7Mo, and Type 301XH stainless steels; and Vascojet 1000 alloy steel. In general, the values for hardness, elastic modulus, and tensile and yield strengths of these materials tended to increase as the test temperature was reduced to -253 C. However, of the eight alloys investigated, the

Ti-6Al-4V and the Ti-4Al-3Mo-1V titanium alloys and the Type 301XH stainless steel were the only ones that did not reveal a serious loss of ductility or did not fracture before reaching 0.2 per cent offset strain at -253 C. (Author)

Bio-Mechanics Lab., Tufts U., Medford, Mass.
LIGHT-WEIGHT SEATING: DESIGN RESEARCH ON A NYLON NET SEAT. ONE OF A SERIES OF STUDIES PERTAINING TO CREW COMPARTMENT HABITABILITY FOR EXTENDED MISSIONS, by Jess Forrest, Edward A. Wade and others. Rept. on Biophysics of Space Flight, Contract AF 33(616)3068. Dec 58, 39p. 18 refs. WADC Technical rept. 58-309; AD-209 380.
Order from OTS $1.00 PB 151 702

This report describes a design research program for a light-weight aircraft seat made from nylon netting. An empirical approach was used to evaluate a series of exploratory designs and to modify solutions on the basis of subjective reports by individuals occupying the seats. A number of specific design problems were investigated with the results indicating that human factors requirements of a seat for long term occupancy can be met by a nylon net seat. (Author)

Chicago Midway Labs., U. of Chicago, Ill.
THERMAL PROTECTION OF STRUCTURAL, PROPULSION, AND TEMPERATURE-SENSITIVE MATERIALS FOR HYPERSONIC AND SPACE FLIGHT. PART I. RELATIVE PERFORMANCE OF ABLATING MATERIALS EXPOSED TO LOW AND HIGH HEAT FLUX ENVIRONMENTS, by John H. Bonin and Channon F. Price. Rept. for Aug-Oct 58 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)6006. May 60, 62p. WADC Technical rept. 59-366, Part I.
Order from OTS $1.75 PB 161 956

The experimental equipment used is briefly described, and test results for 19 different test specimens are presented. The data are used to compare the relative performance of the ablating materials with heat sink materials on a weight-per-unit area basis. (Author)

David Taylor Model Basin, Washington, D. C.
STATIC BEHAVIOR OF A RECTANGULAR PLAN FROM GEM MODEL UTILIZING AN INTEGRATED SYSTEM FOR LIFT AND PROPULSIVE THRUST, by Anibal Alfredo Tinajero. June 60, 29p. 4 refs. Aero rept. 948.
Order from LC mi$2.70, ph$4.80 PB 149 898

Augmentation, propulsive thrust ratios, and efficiency ratios were obtained for range of jet nozzle angles and tangential jet deflection angles. It was confirmed that theoretical equations predicting performance of GEM in hovering regime are valid for all jet-discharge angles, if proper efficiency values are chosen. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A MATHEMATICAL ANALYSIS OF SOME PHASES OF AIR TRAFFIC FLOW, by E. L. Fritz, R. S. Grubmeyer, and R. S. Miller. Rept. on Study of Air Traffic Flow Problems, Contract AF 33(616)3613. July 58, 61p. 5 refs. ARDC Technical rept. 58-57; AD-204 051.
Order from LC mi$3.90, ph$10.80 PB 150 585

This report released for sale to the public 11 Oct 60.

The mechanics of flow control in the enroute area using speed-reduction flow-control methodswere investigated and mathematically defined with suitable models. Since the samples frequently included large numbers of consecutive arrival intervals occupied by aircraft after smoothing, the probability of smoothed groups of aircraft of various sizes was investigated analytically for three values of system loading. The mechanics of flow control in the enroute area were investigated using a combination of speed-up and slow-down control to see what benefits were derived therefrom. Navigation errors were then introduced into the enroute area smoothing problem. The effect of error on the flow-control process was investigated as was a multiple check-point technique for limiting the effect of the error. Some new equipments and procedures required for an efficient speed-control system were discussed. Use of a 30-minute speed-control area at seven airports in the New York and Pittsburgh Air Route Traffic Control areas was examined. The percentage of delay absorbed by slow-down varied from 50% to 97%.

Guggenheim School of Aeronautics, Georgia Inst. of Tech., Atlanta.
AN INVESTIGATION OF AN APPROACH TO THE PROBLEM OF DETERMINING THE OPTIMUM DESIGN OF SHROUDED PROPELLERS. APPENDIX I. VORTEX SYSTEM. APPENDIX II. CALCULATION OF THRUST AND POWER. APPENDIX III. DETERMINATION OF THE OPTIMUM LOADING FOR A HEAVILY LOADED PROPELLER HAVING AN INFINITE NUMBER OF BLADES. APPENDIX IV. OUTLINE OF DESIGN PROCEDURES FOR SHROUDED PROPELLERS, by Robin B. Gray and Walter Castles, Jr. Rept. on Contract DA 44-177-TC-24. May 60, 92p. 7 refs. TREC 60-44.
Order from LC mi$5.40, ph$15.30 PB 150 116

Two methods of obtaining the necessary optimum combination of design parameters for a lightly loaded, single rotation shrouded propeller are described for the case in which the ultimate wake vortex system moves as a rigid body and is composed of helical vortex filaments of equal geometric pitch. One method employs the electrical potential tank techniques while the other uses a digital computer to numerically integrate the Biot-Savart relation. The optimum blade bound vortex distribution for a two-bladed and a four-blade propeller having an ultimate wake geometric pitch of 1.356 as determined by the potential tank method is presented for illustrative purposes. The results of the computer method were inconclusive due to time and financial limitations. However, it is concluded that the digital computer approach is the more promising and the recommendation is suggested that any further work be in this area. (Author)

Hiller Aircraft Corp. [Palo Alto, Calif.]
ANNULAR NOZZLE EJECTOR, SUMMARY REPORT, PHASE I PROGRAM, by C. H. Spiegelberg. Rept. on Contract Nonr-2840(00). Nov 59, 57p. 8 refs. Rept. no. ARD-243.
Order from LC mi$3.60, ph$9.30 PB 150 209

The purpose of the complete program is to show the effect of scale and the elevated temperature of the primary flow on ejector performance through the design, construction and testing of a full scale annular nozzle ejector using a jet engine as the source of the hot primary gas. Phase I of the program included small scale model tests for determining the geometry of the full size hardware and also includes detail design of the full scale ejector and test hardware.

Just, W.
LATERAL-DIRECTIONAL STABILITY AND CONTROL OF HELICOPTERS. EFFECT OF DESIGN PARAMETERS, by W. Just, H. Georgi, and U. Schwellinger. Final Technical rept. no. 1, 1 Oct 58-30 Oct 59, on Contract DA 91-591-EUC-959. [1959] 236p. 1 ref.
Order from LC mi$10.20, ph$36.30 PB 149 908

The present theoretical study deals with control and stability investigations of helicopters, especially with lateral-directional stability. Theories of various degrees of accuracy have been presented and compared against each other. In order to ascertain the effect of the design parameters upon the stability qualities, numerous examples have been computed. Diagrams have been plotted against the design parameters for the time to damp to 1/2 amplitude, for the time to double the amplitude or, for the period of oscillation, as well as for the stability measurement t_W/T resp. t_D/T. Furthermore, the courses of motion as functions of time have been computed for excitations in form of square pulse, step pulse, and sinusoidal pulse. (Author)

Michigan U. [Research Inst.] Ann Arbor.
MODERN ICING TECHNOLOGY - LECTURE NOTES, by Myron Tribus. Rept. on Contract AF 18(600)51. Jan 52, 155p. 98 refs. ATI-139 596.
Order from LC mi$7.50, ph$24.30 PB 152 052

This report released for sale to the public 14 Oct 60.

Contents:
An introduction to the icing problem
Trajectories of water drops around streamlined bodies
Removing the ice
The energy transfers at an icing surface
Analysis of the separate modes of energy transfer
The complete energy balance and some applications
The design of a continuously anti-iced air-heated wing
Intermittent heating
Meteorological conditions for design

National Aviation Facilities Experimental Center, Atlantic City, N. J.
AIRCRAFT INSTALLATION AND OPERATION OF AN EXTINGUISHING-AGENT CONCENTRATION RECORDER, by James E. Demaree and Paul R. Dierdorf. 25 Sep 59, 35p. 1 ref. Technical Development rept. no. 403.
Order from OTS $1.00 PB 161 991

This report covers the utilization of a gas-analyzing instrument for evaluating aircraft fire-extinguishing systems. This instrument records the extinguishing-agent air concentrations resulting when the extinguishing system is discharged, and thereby provides a means of evaluating the aircraft extinguishing system under actual flight conditions. This report is intended to serve as an instruction manual for installation and operation of the instrument. Calibration data based on available information to aid in the reduction and interpretation of the test data obtained also are included The instrument and the principles of operation are described briefly. (Author)

National Aviation Facilities Experimental Center, Atlantic City, N. J.
INSTALLATION AND TESTING OF VISUAL GLIDE PATH INDICATORS, by Richard S. Griffith. Final rept. June 60, 87p. 12 refs.
Order from OTS $2.25 PB 161 992

Flight tests were conducted to comparatively evaluate five different types of visual glide path indicators. The systems installed at the National Aviation Facilities Experimental Center (NAFEC) were: Westinghouse Tri-Color, Navy Mirror, USAF Interim Mirror, Australian Cumming-Lane, and British RAE. All of the systems were set up on Runway 13, and as nearly as possible, each system was adjusted to the same vertical angle as the ILS glide path. A wide cross section of pilots from all segments of aviation participated. A cross section of aircraft was employed, from a Piper Tri-Pacer to the Boeing 707. Initial testing was directed toward selecting the more promising systems followed by concentrated testing and comparative evaluation of the selected systems. Accordingly, the last six weeks of the program were devoted to comparative evaluation of the Australian Cumming-Lane and the British RAE system. Subjective data indicate that more pilots prefer the RAE system than prefer the Cumming-Lane. All pilots but one indicated that a requirement exists, under certain conditions, for visual glide path assistance. Theodolite recordings show that no significant differences exist in the maximum range at which the lights can be seen (with respect to the systems named above), or in the maximum range at which guidance is available. The RAE system, however, provides guidance to a lower altitude than does the Cumming-Lane system. (Author)

National Research Labs., Ottawa (Canada).
RADIAL GRIDS WITH WATER INJECTION FOR SUPPRESSING THE NOISE OF JET ENGINES, by H. U. Wisniowski. 21 Mar 60, 31p. 13 refs. Aeronautical rept. LR-281.
Order from LC mi$3.00, ph$6.30 PB 149 744

Noise-suppression experiments were made with water sprays introduced into the stream of exhaust gases from a jet engine by means of radial grids with tubular perforated arms. This method proved to be very satisfactory for the test cell installation with an appreciable length of exhaust duct. An over-all noise-level reduction of 31.5 db. was obtained at a water flow rate of 259 Imp. gal./min. for a jet engine of 100 lb./sec. mass flow. In the field installation, the

method was found less attractive because of the necessity of using a rather long exhaust duct to obtain higher noise attenuation. It was shown that a cylindrical shroud mounted on the grid suppresses the noise (called "hoot") produced when the grid is mounted too far from the engine final nozzle. (Author)

Office of Defense Research and [Engineering] Washington, D. C.
CHARACTERISTICS OF MAJOR UNITED STATES TRANSONIC AND SUPERSONIC WIND TUNNELS AND AIR-BREATHING ENGINE TEST FACILITIES.
3 Oct 56, 34p. Coordinating Committee on Aeronautical Facilities rept. CAF-201/2; AD-115 871.
Order from LC mi$3.00, ph$6.30 PB 149 072

This survey contains data on major United States wind tunnels and engine test facilities owned by the Department of Defense, the National Advisory Committee for Aeronautics (NACA), universities and industrial organizations. Facilities in operation, under construction and currently authorized are included.

[Pacific] Missle [Range] Port Mugu, Calif.
NOISE AND VIBRATION TEST OF THE KD2G-1 (FIREFLY) TARGET P/A, by Everett O. Throndsen. 22 June 49, declassified 12 June 56, 53p. Proj. TED MTC PA-203; Technical rept. no. 50.
Order from LC mi$3.60, ph$9.30 PB 148 628

A series of vibration tests of the KD2G-1 (FIREFLY) target pilotless aircraft was conducted to: (a) measure the frequencies and amplitudes of vibration present at various points of the airframe as a result of operation of the pulsejet engine, (b) measure the over-all level and frequency content of the acoustic noise within the fuselage when the engine is operating, (c) make a functional check of KD2G-1 equipment during periods of engine operation.

[Pacific] Missile [Range] Port Mugu, Calif.
STABILITY AND CONTROL ANALYSIS OF THE RPS-2 AUTOPILOT/KD2R-2 AIRFRAME COMBINATION, by L. E. Day. Rept. on Proj. TED MTC EL-310. 15 Jan 50, declassified 12 June 56, 109p. 12 refs. Technical rept. no. 65.
Order from LC mi$5.70, ph$16.80 PB 148 634

An analysis has been made of the stability and control characteristics of the RPS-2 autopilot and KD2R-2 target P/A combination. This analysis was based on the frequency-response characteristics of the autopilot that were obtained by laboratory tests and on the calculated aerodynamic frequency-response characteristics of the airframe. The characteristics of both the autopilot and the airframe were combined in accordance with standard servomechanism theory. Stability was determined by the Nyquist criterion.

[Pacific] Missile [Range] Port Mugu, Calif.
TESTS OF THE KD2C-1 POWER PLANT, by Ray Fremlin. 24 Mar 50, declassified 12 June 56, 69p. Technical rept. no. 69.
Order from LC mi$3.90, ph$10.80 PB 148 635

Captive flight tests were made with the KD2C-1 (SKEET) target P/A that incorporated an internally mounted 14-inch pulsejet engine. These tests were made to evaluate performance of the power plant and to compare the performance with that of an identical, bare engine mounted externally in the free air stream.

Princeton U., N. J.
EFFECT OF C. G. POSITION, DUCT AREA RATIO AND DUCT ANGLE RATIO ON THE PERFORMANCE OF AN AERIAL JEEP, VTOL TYPE AIRCRAFT, by Joseph J. Traybar. Rept. on Contract DA 44-177-TC-524. Jan 60, 47p. 6 refs. Dept. of Aeronautical Engineering rept. no. 494.
Order from LC mi$3.30, ph$7.80 PB 150 186

Theoretical investigations are made on the performance of aerial jeep-type aircraft as influenced by various configuration changes. The primary objective of this report is the study of the relative effects on the power caused by selected design variations rather than the determination of the total power required for a specific vehicle. Attention is given to a configuration which utilizes ducted rotors in a triangular arrangement. It is assumed that the ducted rotors can be rotated with respect to the fuselage and that control is obtained by differential variations in thrust. The forward flight equilibrium equations are derived using simple momentum theory where duct angle of attack, exit slipstream velocity and forward speed are the variables. The specific quantities changed in order to determine their relative effects on the power are duct area ratio, duct angle of attack ratio and longitudinal center of gravity location. (Author)

Republic Aviation Corp., Farmingdale, N. Y.
THEORETICAL INVESTIGATION OF DUCTED PROPELLER AERODYNAMICS. VOLUME I. THEORETICAL DEVELOPMENTS, by Th. Theodorsen. Rept. on Contract DA 44-177-TC-606. 10 Aug 60, 87p.
Order from LC mi$4.80, ph$13.80 PB 149 934

This report covers certain theoretical developments, including some new ones of fundamental aspects. The theory of the line sink in a two-dimensional wing represents a classical solution in the airfoil theory. Closed expressions are given for the hitherto unknown pitching moment. There is a short appendix giving certain specific design and performance problems.

Republic Aviation Corp., Farmingdale, N. Y.
THEORETICAL INVESTIGATION OF DUCTED PROPELLER AERODYNAMICS. VOLUME II. REVIEW AND ANALYSIS OF EXPERIMENTAL INVESTIGATIONS ON DUCTED FANS, by Th. Theodorsen. Rept. on Contract DA 44-177-TC-606. 10 Aug 60, 250p. 84 refs.
Order from LC mi$11.10, ph$37.80 PB 149 935

A comprehensive survey of published experimental work on ducted fan configurations is made, which gives an outline of some analytic relations used to document and analyze experimental result. It then selects a number of experimental papers which make significant and consistent contributions and analyzes

their results in detail. Major subsections deal with the performance in the static or hovering case of the configuration, with performance fields for the case where the fan is moving in axial direction and with the analysis of the performance in non-axial flow which is the flow encountered by a configuration making a transition from hovering to forward flight. Specific observations derived from the analysis, concerning the distribution of rolling and pitching moments for a shrouded and unshrouded propeller, evidence and recognition of flow separation on the shroud, etc., follow. Special arrangements of fans in wing, multiple fan arrangements, and ground proximity effects are reviewed. The concluding part briefly reviews the general considerations that go into the design of ducted fan systems. (See also PB 149 934)

Chemical Engineering

Electric Boat Div., General Dynamics Corp., Groton, Conn.
WATER RECOVERY SYSTEMS (MULTI-VARIABLE) by Harold Wallman and Stanley M. Barnett. Rept. on Equipment for Life Support in Aerospace, Contract AF 33(616)6425. Mar 60, 76p. 50 refs. WADD Technical rept. 60-243.
Order from OTS $2.00 PB 171 022

A study has been conducted to determine the optimum design of several urine-to-potable-water recovery systems for use on space flights having different flight durations and crew sizes. Phase change processes, solvent extraction, ion exchange, membrane processes and integrated systems are covered. On the basis of the evidence presented, it has been recommended that: (1) a simple distillation unit be used for flights of six or more with up to two men, (2) a vapor compression system be used for long flights (four days or more) having large crews (three to twenty men), and (3) sufficient water be stored aboard the vehicle for flights of short duration. Recommendations are also made for a laboratory study of other promising methods of water recovery. It has been concluded that a healthy man can ingest water reclaimed from urine without incurring any harmful effects. (Author)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
STUDIES AND INVESTIGATIONS OF AGGLOMERATION AND DEAGGLOMERATION OF SOLID PARTICLES, by Clyde Orr, Jr., J. M. Dallavalle and others. Final rept. 15 June 57. 76p. 5 refs. AD-150 490.
Order from LC mi$4.50, ph$12.30 PB 150 131

The deagglomeration of powder masses and the tensile strength of powders were investigated. Deagglomeration was studied by blowing powders with a series of gas pressures through capillary tubes of various diameters and lengths. Particle size distributions were determined after passage through the tubes, and the velocity of powder movement was determined by high-speed photography. Deagglomeration was also carried out by blasting powders through an annular port at various pressures. The tensile strengths were measured by forming a bed of powder on a device one part of which moved on precision ball bearings. Essentially complete deagglomeration was attained for all powders For the finest powders, this required a gas pressure of 400 psi, a tube diameter no greater than 0.02 in., and a tube length of up to 3 inches. The tensile strengths of bulk, dry, biological powders were in the range of 2×10^{-3} to 9×10^{-3} psi, or less than the strength of the material of which the powder was composed. The tensile strengths of bulk uncompacted FT-3 and FP were 8.6×10^{-3} and 6.0×10^{-3} psi. respectively. No definite correlation existed between the bulk tensile strength of powders and its ease of dispersibility. The force of adhesion of spheres to solid surfaces was proportional to the particle diameter. Washing generally increased the dispersibility of bacterial powders. Grinding had less influence on dispersion. (See also PB 140 304).

Office of Saline Water, Washington, D. C.
ONE MILLION GALLON PER DAY LONG TUBE VERTICAL EVAPORATOR MULTIPLE EFFECT DISTILLATION PLANT AT FREEPORT, TEXAS. Rept. on Contract OSW 14-01-001-195. 24 May 60, 347p. Specification no. 195.
Order from LC mi$11.10, ph$53.10 PB 148 924

Specifications, special requirements, technical requirements, detailed specifications.

Pennsylvania State [U., University Park].
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 4 for 1 Apr-1 July 52. 1 July 52, 63p. 21 refs.
Order from LC mi$3.90, ph$10.80 PB 150 128

The dimensional analysis for the swirl chamber atomizer is presented. It was found that an analysis based on initial conditions at the orifice versus an analysis based on the design parameters was possible. This lead to the formulation of the mode of atomization, mean droplet diameter ratio, and orifice diameter ratio, as functions of the Reynolds Number, Z number, T number peculiar to the swirl chamber atomizer and angles of spray. A recapitulation of a Study of Aerosols in general is discussed. Conditions for aerosols formation before, during and after atomization are explained. The process of film formation is discussed. In order to lessen the burden of a mathematical analysis it was suggested that the elimination of the rotational component in the film formation be achieved by having laminar liquid flow impinge on a flat circular disk. The subsequent disintegration phenomena for four cases (spurious, drop, ligament and film formation) is presented.

Pennsylvania State [U., University Park].
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 5 for 1 July-1 Oct 52. 1 Oct 52, 49p. 31 refs.
Order from LC mi$3.30, ph$7.80 PB 150 129

Chapter I is essentially a thorough critique of a recent Russian treatise on capillary waves. Some errors in it have been pointed out, and the treatment therein has

been extended. Further expansion of the theory of stability of two liquid surfaces is indicated. Chapter II presents some contributions to the theory of sedimentation and decay of aerosols, based essentially on an existing detailed treatment by Dr. Charles A. Boyd. The problems of correction of mass-percent recovery and of the particle-size distribution are dealt with in some detail. (See also PB 150 128)

Pennsylvania State [U., University Park] Pa.
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 6 for 1 Oct-31 Dec 52. 1 Jan 53, 80p. 67 refs.
Order from LC mi$4.50, ph$12.30 PB 149 986

Chapter I is the description of the Spray Chamber with its auxiliary equipment, namely the Hydraulic System, the Shutter-Mechanism, the Vacuum System for Sampling, and the Exhaust System. Chapter II is a critical analysis, from a statistical point of view, of the several droplet-size distribution formulas which have been proposed in the past. It is proposed that the population distribution of droplet sizes be described by use of the confidence-interval technique. Chapter III contains about 60 new titles dealing with literature in the field of sprays, together with their brief abstracts. These will be incorporated in the new edition of the "Bibliography on Sprays" which is under preparation at present. Chapter IV contains the photographs and drawings pertaining to the Closed Spray Chamber and its Auxiliary Equipment. (Author)

Pennsylvania State [U., University Park]
A BASIC STUDY OF THE PHYSICS OF AEROSOL FORMATION. Quarterly technical rept. no. 7 for 1 Jan-31 Mar 53. 1 Apr 53, 76p. 6 refs.
Order from LC mi$4.50, ph$12.30 PB 150 130

Chapter 1 is a derivation of the most general form of the Orr-Sommerfeld equation for laminar boundary layers. In Chapter 2 the theory of conformal mapping with free streamlines is applied to jet theory. Chapter 3 presents an attempted extension of the theory of Borodin and Dityakin 1951 for the instability of the interface of two viscous fluids to the case of a sheet. Work on size distribution by the settling method is covered in Chapter 4. Chapter 5 presents a brief introduction to the subject of spinning disc atomization. Chapter 6 is a summary of the work done on nozzle and shutter calibration in an attempt to get reproducible amounts of fluids sprayed into a closed tank. (See also PB 150 129)

Civil Engineering

Army Engineer Research and Development Labs., Fort Belvoir, Va.
RESPONSE OF AN ELASTO-PLASTIC SINGLE DEGREE OF FREEDOM SYSTEM TO AN EXPONENTIALLY DECAYING BLAST WAVE, by James W. Maloney. 23 June 59, 64p. Technical rept. 1581-TR; AD-228 734.
Order from LC mi$3.90, ph$10.80 PB 150 200

The complete spectrum of results of an elasto-plastic single degree of freedom system subjected to the classical exponentially decaying blast wave is presented in dimensionless form. The equivalent triangular pulses to give the same maximum displacement and time of maximum response and the response of the rigid plastic system are presented as appendices. (Author)

Bureau of Supplies and Accounts, Navy Dept., Washington, D. C.
DESIGN AND OPERATION OF DEHUMIDIFIED NAVAL WAREHOUSES. July 54, 64p. NAVSANDA PUB. 230.
Order from LC mi$3.90, ep$12.30 PB 149 615

This report released for sale to the public 23 Sep 60.

Part A covers the operation of the dehumidification equipment, care and maintenance of instruments, and the maintenance of the warehouse as a container for materials. Part B covers the storage of materials in dehumidified warehouses, preparation of the material for storage, and the coordination of material handling operations with open door time to reduce the admission of humid air.

Engineer Corps, Washington, D. C.
SOIL AS A FACTOR IN SHOALING PROCESSES, A LITERATURE REVIEW. June 60, 51p. 81 refs. Technical Bulletin no. 4.
Order from LC mi$3.60, ph$9.30 PB 149 742

This literature survey was made to assess, on the basis of available information, the probable influence of soil properties on the transport, deposition, and stability of shoal materials in estuaries. Descriptions are presented of the physical and engineering characteristics of soil, particularly the clay minerals, kaolinite, montmorillonite, and illite, which are carried in suspension and may be deposited in shoal areas. The various factors influencing the process of sedimentation are discussed; these include hydraulic factors, sediment type and concentration, salinity, temperature, pH, organic matter, industrial wastes, etc. Finally, available information is presented on the mode of deposition and physical characteristics of the sediment deposits. The results of the literature survey show that the principal source of shoal materials is suspended, fine-grained soil material carried into an estuary by fresh-water streams. The suspended sediment tends to flocculate in the presence of salt water, forming aggregates which settle to the bottom and form shoals. The rate of settling is influenced primarily by the salinity of the water; temperature and turbulence of the water, and nature and concentration of the soil particles are of lesser importance.

Electrical and Electronic Engineering

Admiral Corp., Chicago, Ill.
EVALUATION AND DEVELOPMENT OF MIL-C-14157 CAPACITORS FOR NUCLEAR RADIATION ENVIRONMENT, by E. R. Pfaff. Scientific rept. no. 4 on Contract NObsr-77612. Aug 60, 129p. 1 ref.
Order from LC mi$6.30, ph$19.80 PB 149 902

In the second environmental test all of the irradiated samples failed in 312 hours. Twenty-one of the fifty control units remained on test at 320 hours. Units with C_{16-18} Alkyl biphenyl dielectric fluid failed very rapidly. The failure rate for Bis(phenoxyphenyl) either unit was similar to the standard unit and slightly lower for the Monoisopropylbiphenyl unit. With the special units the gas formation is no longer a problem. The addition of inhibitor may improve the gamma failure rate of these units significantly and the use of the larger group will improve the statistical significance of the results. (Author) (See also PB 148 237)

Aerial Reconnaissance Lab., Wright Air Development [Div.] Wright-Patterson AFB, Ohio.
THE MATHEMATICS OF FRESNEL REGION FIELD DISTRIBUTIONS FOR PLANE RECTANGULAR APERTURE ANTENNAS, by Arthur L. Haywood. Master's thesis. Rept. for Nov 58-Jan 59. [1959] 13p. 16 refs. WADC TR-59-462; AD-230 705.
Order from LC mi$2.40, ph$3.30 PB 150 591

This report released for sale to the public 11 Oct 60.

The problem of determining the near-field gain of a plane rectangular aperture antenna is treated quantitatively. The Fresnel integrals are used as the chief mathematical tool in evaluating the double integrals for electrical intensities in the far-zone (Fraunhofer region) and the near-zone (Fresnel region). The study ends with the quantitative determination of operationally significant quantities in important practical systems. The systematic formulation of this antenna theory and its application are directed to the mathematician whose primary interest is rigor, and the practical engineer who desires only a final working formula or a set of charts. The mathematical representations are in forms that provide an insight into the physical aspects of the problem and reasonable quantitative accuracy in their numerical evaluation. (Author)

Aeronautical Electronic and Electrical Lab., Naval Air Development Center, Johnsville, Pa.
EVALUATION OF MIDGET-TYPE, 28-VOLT, DIRECT-CURRENT RELAYS. Final rept. Rept. on TED Project no. ADC-EL-52059. 4 Aug 54, 11p. 6 refs. Rept. no. NADC-EL-L5457 (Revision A), supersedes same of 25 May 54; AD-44 470.
Order from LC mi$2.40, ph$3.30 PB 152 020

This report released for sale to the public 11 Oct 60.

Ten commercially available midget-type, 28-v, dc, 2-pole and 4-pole double-throw relays were evaluated for conformance with the drawing requirements and applicable requirements for Spec. no. MIL-R-6106 (ASG). Seven of the 10 relays were unsatisfactory. The following midget-type, 28-v, dc relays were approved for use in naval aircraft: (1) type R, parts no. A-54504 and B-54504; (2) type SM, parts no. 28026-0, revision A, and 28027-0, revision A; and (3) type TM, parts no. C4595 and C4596.

Air Crew Equipment Lab., Naval Air Material Center, Philadelphia, Pa.
MULTIPURPOSE ELECTRONIC TIMER, by R. L. Burdick. Rept. on TED Projects NAM AE-1403 and AE1403.2. 27 Oct 59, 13p. NAMC ACEL-420; AD-228 355.
Order from LC mi$2.40, ph$3.30 PB 149 554

An economical, versatile, and dependable electronic timer was developed for intervals of 0.1 to 30 sec which can be used to control apparatus or machinery. Three modes of operation are available: (1) a momentary electrical event initiates a condition of predetermined duration; (2) an electrical event of sufficient duration initiates a condition of predetermined duration; and (3) two conditions, each of independent and predetermined duration, alternate. In addition, external signals may be superimposed to (1) begin an interval in progress over again or (2) terminate an interval in progress producing the same effect as if the interval had been permitted to terminate normally. Dependability, accuracy, and stability are discussed. Construction, calibration, and operation instructions are included, together with suggestions for integrating this timer with particluar needs. (Author)

Airborne Instruments Lab., Inc., Mineola, N. Y.
STUDY OF PRINTED ANTENNAS, by J. A. McDonough, R. G. Malech, and J. Kowalsky. Final rept. for June 54-July 55 on Contract DA 36-039-sc-63116. Aug 55, 57p. 6 refs. Rept. no. 3232-1.
Order from LC mi$3.60, ph$9.30 PB 150 677

This report released for sale to the public 11 Oct 60.

This report discusses several types of printed antenna arrays and related feeds and baluns. Detailed consideration is given to the Franklin array, Chireix-Mesny array, and the capacitively coupled collinear array. Experimental techniques, such as probing the magnitude and phase distribution of the current along a printed array and measuring the impedance and phase velocity that characterize printed balanced lines are described. The antenna performance characteristics for the types of arrays that were studied are given, including gain, loss, impedance, size, side-lobe levels, and half-power beamwidths.

Alford, Andrew, Consulting Engineers, Boston, Mass.
ANTENNA GROUP OA-716(XE-1)/GL, by Fred Abel and W. Hugo Liepmann. Final technical rept. on Contract DA 36-039-sc-64491. Jan 60, 28p. 6 refs. AD-236 104.
Order from LC mi$2.70, ph$4.80 PB 148 545

The Antenna Group OA-716(XE-1)/GL is a passive, high-gain, transportable, search antenna system used with a receiving set to detect the presence of electromagnetic signals throughout the frequency range of 12,000 megacycles to 18,000 megacycles. A broadly directional antenna, 10 - 15° horizontal beam width, is used for searching. A highly directional antenna, 1 - 1.5° horizontal beam width, is used for direction finding. The vertical beam width of both antennas is 10 - 15°. Both antennas are circularly polarized. Position or velocity servos are used to rotate the antennas. The azimuth orientation of the antennas is indicated on direction indicator dials, and the intercepted signal may be fed to a receiving set. A broadband waveguide rotary joint was developed for use in this antenna system. The device involves a pair of broadband circularly polarized horns coaxially arranged pointing into one another. The transfer of energy from one horn to the other is very nearly

constant as one horn is axially rotated with respect to the other, and the transfer is accomplished with very little attenuation (about 1 db) over a 1.5 to 1 frequency range. (Author)

Applied Mathematics and Statistics Labs., Stanford U., Calif.
INCREASED RELIABILITY WITH MINIMUM EFFORT, by Arthur Albert and Frank Proschan. Technical rept. no. 50 on Contract N6onr-25140. 9 Oct 59, 29p. 2 refs. AD-227 453.
Order from LC mi$2.70, ph$4.80 PB 149 943

A specific mathematical model is formulated describing the situation of improving the system reliability with minimum expenditure of effort. Also shown is how to determine that allocation of effort among subsystems which yields the desired system reliability at minimum total expenditure of effort.

Arizona U., Tucson.
TRANSISTOR EQUIVALENT CIRCUIT CRITERIA, by Thomas L. Martin, Jr., David J. Sakrison and others. Final rept. on Contract DA 36-039-sc-67465. 30 Aug 56. 83p. 7 refs. AD-107 814.
Order from LC mi$4.80, ph$13.80 PB 147 539

A hybrid parameter equivalent circuit for the common emitter connection is developed. The basic circuit is modified for high frequency use in such a way that the parameters of the equivalent circuit are independent of frequencies. Methods of measuring these various parameters are discussed in detail and circuit diagrams are provided for each such measurement. The proposed transistor equivalent circuit is then used in the analytical development of circuit design equations and criteria for low pass, high pass, and band pass amplifiers. (Author)

Armour Research Foundation, Columbus, Ohio.
INVESTIGATION AND DEVELOPMENT OF CIRCULAR WAVEGUIDE COMPONENTS, by Alva C. Todd, Dick M Joe, and Demetrios P. Kanellakos. Rept. on Contract AF 33(616)3973. Apr 59, 136p. 16 refs. WADC Technical rept. 58-661; AD-207 247.
Order from LC mi$6.90, ph$21.30 PB 150 589

This report released for sale to the public 11 Oct 60.

The design and development are presented of components for use in a circular waveguide system employing the low-loss TE_{01} circular electric wave mode. Components were investigated with regard to direct scaling for use with 2.710-in. ID and 0.725-in. ID circular waveguide at 9.375 kmc and 35 kmc, respectively. Direct scaling for the increased waveguide diameter used in this program was found practicable in certain cases, however, in other instances major modification of dimensions were required. Some new components were developed. These components include a straight waveguide section, a flexible waveguide section, couplings, transitions, bends, a mode absorber, a rotary joint, a high-power load, a low-power load, waveguide switches and windows. Proposed designs are presented for directional couplers and ferrite components. All experimental work was done in the X-band. (Author)

Army Ordnance Human Engineering Labs., Aberdeen Proving Ground, Md.
SYNTHETIC VIDEO AS AN ELECTRONICS COUNTER-COUNTER MEASURE: A STUDY OF PULSATED AND STEADY STATE SYMBOLOGY, by Charles Fried and Claude D. Patton. Aug 60, 24p. 5 refs. Technical memo. 11-60.
Order from LC mi$2.70, ph$4.80 PB 150 087

A study was conducted to determine the effectiveness of pulsing a suggested Antiaircraft Operations Center (AAOC) symbol in overcoming the concealment effects of white noise jamming. Pulsing resulted in a flickering symbol on a Plan Position Indicator. Four degrees of jamming intensity were studied along with four flicker rates, 0, 2, 4, and 8 cycles per second. The psychophysical technique of method of limits was used to determine if flicker improved detection with a background of jamming. The results indicate that no advantage is gained in pulsing a synthetic symbol in overcoming the effects of jamming. A discussion of this result with a review of procedures is included. (Author)

Army Signal Research and Development Labs., Fort Monmouth, N. J.
CHARACTERISTICS OF MICROWAVE DUPLEXER TUBES UNDER SPURIOUS RADIATION CONDITIONS, by Irving Reingold. 31 Mar 59, 27p. 5 refs. USASRDL Technical rept. 2042; AD-220 395.
Order from LC mi$2.70, ph$4.80 PB 147 821

An investigation was conducted on several types of TR duplexer tubes and a waveguide filter commonly used in systems, to determine their effectiveness in rejecting spurious microwave radiation. The devices studied were all designed for operation in the 2800-megacycle frequency band. The low power level characteristics of these devices were checked over a frequency range of 2600 to 35,000 megacycles. Results of the investigation showed that neither the TR tube nor the waveguide filter can be relied upon to provide adequate protection against unwanted signals at frequencies higher than the operational frequency of the system incorporating the device. Other techniques for providing crystal protection without undue sacrifices in insertion loss, or other operational system characteristics, are described and recommended for use by microwave system designers. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
FREQUENCY REPEATABILITY OF CRYSTAL IMPEDANCE METER TS-330/TSM, by Marvin Bernstein. 15 May 60, 12p. USASRDL Technical rept. 2118; AD-237 335.
Order from LC mi$2.40, ph$3.30 PB 149 415

Quartz crystal units, operated within the frequency range of 1.0 to 15.0 mc, were subjected to repeated frequency measurements after simulating the recalibration of the C. I. Meter TS-330/TSM by readjusting the oscillation amplitude level and frequency of the test set in the calibrate condition. Generally, it was found that the oscillation frequency of plated AT resonators is critically dependent upon drive; that the 0 to 100 milliampere RF meter cannot be used to adjust the drive level within accurate enough limits; that with a proper

standardized test procedure, frequency resettability of the Crystal Impedance Meter TS-330/TSM is better than 10^{-7} throughout the range of the instrument except at the very lowest capacitance settings of the tuning dial. (Author)

Army Signal [Research and Development Lab.] Fort Monmouth, N. J.
RADAR-TYPE PROPAGATION SURVEY EXPERIMENTS FOR COMMUNICATION SYSTEMS, by C. E. Sharp. Nov 57, 23p. Technical memo. no. M-1928, supplement to TM-1760; AD-156 257.
Order from LC mi$2.70, ph$4.80 PB 148 120

SCEL Technical Memorandum 1760 "Radar-Type Propagation Survey Experiments for Communications" presented the need for additional frequency channels, reviewed the various methods of site survey for microwave relay systems and the requirement for a rapid survey instrument. This memorandum is considered as supplementary to TM-1760 giving additional supporting experimental data and a discussion of other application aspects of this radar backscatter communications equipment siting method.

Army Signal Research and Development Lab., Fort Monmouth, N. J.
SPEECH SECURITY FOR TACTICAL OPERATIONS, by Arthur C. Prichard. 1 May 59, 10p. USASRDL Technical rept. 2044.
Order from LC mi$1.80, ph$1.80 PB 147 822

Technical and systems aspects of speech scrambling are considered. Reduced requirements for tactical voice message security can very probably be met to an appreciable extent by an improved version of speech scrambling equipment basically similar to a system developed during World War II. (Author)

Bell Telephone Labs., Inc. [New York]
ENGINEERING SERVICES ON TRANSISTORS, by M. M. Atalla, C. A. Bittmann and others. Interim technical rept. no. 16, 1 Jan-31 Mar 59, on Contract DA 36-039-sc-64618. [1959] 22p; AD-219 227.
Order from LC mi$2.70, ph$4.80 PB 149 001

Transistor reliability: Preliminary results of continuing studies of thermally oxidized silicon surfaces show progress toward a better quantitative understanding and the development of a model for the mechanism of oxidation. New and improved transmission-type transistors: Fabrication of M2107 microwave germanium transistors has shown that structure employing a 0.5 mil wafer thickness and 2 mil by 2 mil mesa are feasible. Evaluation of these transistors indicates that a further reduction of the base width to 1/4 micron and a decrease in the base doping will be necessary to meet the design objectives. Feasibility of the design of the M2090 n-p-ν-n transistor was demonstrated by operation of rated frequency and power output. Control of the diffusion processes has exceeded the objective of 10%. Transistor test methods: Substantial amounts of drawing information up-to-dating, prove-in instruction writing, and remaining equipment design and construction were completed this period on the final model of the 5- to 250-mc transistor phase set. (See also PB 140 251)

Bell Telephone Labs., Inc. [New York].
ENGINEERING SERVICES ON TRANSISTORS, by J. R. Ligenza, C. A. Bittmann and others. Iterim technical rept. no. 17, 1 Apr-30 June 59, on Contract DA 36-039-sc-64618. 15 July 59, 37p. 3 refs. AD-227 825.
Order from LC mi$3.00, ph$6.30 PB 148 329

Transistor reliability: The kinetics of reactions of various alkali hydroxides with thermally grown silicon dioxide on silicon surface were determined. The rate of reaction is temperature dependent and has an activation energy of 17.0 kcal/mol. in the 100 to 300°C temperature range. These reactions provided one controlled means for localized oxide removal necessary for contacting purposes. New and improved transmission type transistors: Evaluation of the M2107 transistor has shown the structure to be capable of operation in the 1 to 5 kmc region. The observation of lower values of f_T than predicted for 1/4 micron base thicknesses indicates the possibility that too high a base surface concentration was employed, and that a modification of the doping levels will be necessary to meet the design objectives. Recent changes in the base layer diffusion process for M2090 transistors have made possible the fabrication of base layer diodes (p-ν-n+) having excellent reverse bias characteristics. A comparison of transistors of comparable maximum frequency of oscillation indicates that oscillator efficiency improves with increasing current gain cutoff frequency. Transistor test methods: Principal remaining work is concerned with accuracy evaluation. (Author) (See also PB 149 001)

Bell Telephone Labs., Inc. [New York]
ENGINEERING SERVICES ON TRANSISTORS, by J. R. Ligenza, B. A. Bittmann and others. Interim technical rept. no. 18, 1 July-30 Sep 59, on Contract DA 36-039-sc-64618. 15 Oct 59, 45p. 1 ref. AD-232 248.
Order from LC mi$3.30, ph$7.80 PB 148 330

Studies have continued on the properties of thermal oxides on silicon, oxidized silicon surfaces, and oxidized silicon junctions. Considerable progress toward a detailed understanding of the process of oxidation has been made recently through study of the infrared transmission properties of the oxide films and the use of the isotopic frequency-shift in the absorption peaks associated with the O^{18} isotope. Work has continued on the M2107 microwave germanium transistor for 3-kmc service and on the M2090 2-watt silicon transistor for service in the 50 to 100-mc band. Processing difficulties have limited the fabrication of M2107 transistors. Theoretical studies and high frequency electrical measurements on the transistors fabricated to date have shown that the initial design chosen was not optimum. M2090 transistors fabricated within the past quarter were capable of delivering 2 watts at over 100 mcps when a collector bias of 80 volts was used. Transistors with thinner intrinsic layers are being fabricated in order to improve the power oscillator performance at lower collector biases. (Author) (See also PB 148 329)

California U., Los Angeles.
ON THE OPTIMUM SYNTHESIS OF SAMPLED DATA MULTIPOLE FILTERS WITH RANDOM AND NONRANDOM INPUTS, by H. C. Hsieh and C. T. Leondes. Rept. on Contract AF 49(638)438. Feb 60, 43p. 8 refs. AFOSR-TN-60-440. AD-239 646.
Order from LC mi$3.30, ph$7.80 PB 149 170

This report considers the synthesis of optimum sampled data multipole filter with n inputs and m outputs. The signal portion of each input is assumed to consist of a stationary random component and a polynomial with unknown coefficients but known maximum order. Each signal is corrupted by stationary random noise. The filter under investigation is linear, time invariant, and has finite memory. Each input to the filter consists of a sequence of impulses with a constant period T. Each impulse is assumed to have an area equal to the value of the signal plus noise at the sampling instant. The synthesis procedure to be developed is to specify the weighting functions of the filter such that the system error, which is defined as the difference between the actual and ideal outputs, has zero ensemble mean and the system ensemble mean square error is minimum. The weighting functions thus obtained will have, in general, abrupt jumps at the sampling instants but they are continuous within the sampling intervals.

Carnegie Inst. of Tech., Pittsburgh, Pa.
ELECTROMAGNETIC PROPERTIES OF INSULATORS, I, by Vinay Ambegaokar (Doctoral thesis) and Walter Kohn. Technical rept. no. 9 on Contract Nonr-760(13). [1959] 43p. 16 refs. AD-227 621.
Order from LC mi$3.30, ph$7.80 PB 148 866

A discussion is presented on the response of a perfect insulator to weak external electromagnetic fields of long wavelength from a many particle point of view. The method is to treat the Coulomb interaction between all electrons to all orders of perturbation theory and analyze the structure of the corresponding Feynman graphs. A result of this graphical analysis shows that the response of the many particle system to long wavelength external fields of arbitrary polarization is completely described by a single frequency-dependent dielectric constant. (Author)

Collins Radio Co., Burbank, Calif.
ELECTROMECHANICAL FILTERS: 100 Kc CARRIER AND SIDEBAND FILTERS, by W. D. Peterson and R. N. Muret. Rept. no. 8 (Final), 1 Apr-30 Sep 57, on Contract DA 36-039-sc-73039. 28 Oct 57, 38p. IDR-W429-3A; AD-201 254.
Order from LC mi$3.00, ph$6.30 PB 149 368

A number of experimental filters have been built to arrive at designs and performance limits consistent with the present state of the art. Results obtained by these filters are discussed and compared with the specifications set forth in Signal Corps Technical Requirements SCL-1721. A discussion of the possible advancement of the state of the art is discussed. A metallurgical research program has shown that powder metallurgy techniques can be employed to produce alloys for disk resonators with excellent characteristics over a wide range of temperatures. These alloys, however, did not exceed the performance characteristics of the batch of commercially available Ni-Span "C" employed in the experimental samples. (Author)

Collins Radio Co., Burbank, Calif.
ELECTROMECHANICAL FILTERS: FEASIBILITY INVESTIGATION FROM 50 KC TO 1 MC, by W. D. Peterson and R. N. Muret. Rept. no. 17 (Final), 1 Apr 57-28 Dec 58, on Contract DA 36-039-sc-73039. 31 Mar 58, 25p. IDR-W429-5; AD-201 255.
Order from LC mi$2.70, ph$4.80 PB 149 369

This report covers the feasibility of fabricating electromechanical filters to the requirements of SCL-1721 in the frequency range of 50 Kc to 1 Mc. Probable characteristics of filters in this frequency range are compared by means of curves. Relative advantages and/or disadvantages are discussed for the various frequencies. Conclusions are drawn as to which of the possible frequencies might be the best choice for optimum filter characteristics. (Author)

Columbia Radiation Lab., New York.
RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM, by P. Kusch. Quarterly progress rept. no. 1, 16 Dec 59-15 Mar 60, on Contract DA 36-039-sc-78330, and rept. on Contracts Nonr-266(45), AF 49(638)-(-507, -557, and -631). 15 Mar 60, 41p. 25 refs. CU 3-60 SC-78330.
Order from LC mi$3.30, ph$7.80 PB 147 633

Cerenkov radiation in the K-band range has been observed in a system that has recently been under design and study. An experimental investigation of the parameters governing the generation of power has been started. An M-band maser radiotelescope is in an advanced stage of design and construction and details of the system are described. The purpose of the radiotelescope is to obtain data from which it should be possible to determine the density of oxygen in the atmosphere as a function of height above the earth's surface. Progress in the design of a maser to operate at the frequency of the hyperfine structure line of atomic hydrogen is reported. Studies directed in the achievement of maser action at infra-red frequencies are continuing. Molecular spectroscopy by use of masers is discussed. Work in a variety of studies of atomic hyperfine structures by several techniques is reported. (See also PB 146 112)

Cruft Lab., Harvard U., Cambridge, Mass.
A DIPOLE ANTENNA COUPLED ELECTROMAGNETICALLY TO A TWO-WIRE TRANSMISSION LINE (THEORETICAL AND EXPERIMENTAL STUDIES) by Kun-Mu Chen. Scientific rept. no. 6 (Series 2) on Contract AF 19(604)4118. 10 Mar 60, 67p. 7 refs. AFCRC-TN-60-387.
Order from LC mi$3.90, ph$10.80 PB 150 197

A dipole antenna coupled electromagnetically to a two-wire transmission line is studied theoretically and experimentally. The antenna currents induced when the transmission line has (1) a standing-wave pattern, (2) a traveling-wave pattern, (3) an unbalanced current, are considered. The variations of antenna currents

with (1) the angle of rotation of the antenna, (2) the length of the antenna, (3) the distance separating the antenna from the line, (4) the spacing of the line, are investigated. (Author)

David Sarnoff Research Center, Princeton, N. J.
MOLECULAR AMPLIFIERS AND GENERATORS, by H. R. Lewis. Triannual progress rept. no. 5, 1 Feb-31 May 59, on Contract DA 36-039-sc-73031. 15 June 59, 16p. AD-225 337.
Order from LC mi$2.40, ph$3.30 PB 149 367

Equipment was set up and tested for paramagnetic resonance work in the 40-50 kmc range and the 50-70 kmc range. The hamiltonian describing the energy levels of Cr^{3+} in TiO_2 was checked by observing the spectrum at frequencies of 45 and 57 kmc. The spectrum was previously observed only at 9 and 24 kmc. A program was written for the IBM 650 computer to calculate transition probabilities for spin 3/2 ions in axial or othorhombic environments. Using this program, computations were made for the Cr^{3+} ion in TiO_2 at points of interest for maser operation. Population inversion was observed at 4.2°K in Cr^{3+} in TiO_2. While the population difference achieved was not sufficient to produce amplification, it is believed that minor modifications will produce an operating maser using this new material shortly. The signal frequency in this experiment was 24 kmc; the pump frequency was 50 kmc. (Author)

Davies Labs. Div., Minneapolis-Honeywell Regulator Co., Beltsville, Md.
HETERODYNE FREQUENCY METER AND CALIBRATOR, by R. W. Gran. Final development rept. for 12 Mar 53-30 June 57, on Contract NObsr-63310. 15 July 57, 25p. AD-141 003.
Order from LC mi$2.70, ph$4.80 PB 148 856

A heterodyne frequency meter has been developed which will measure frequencies directly to six significant figures over a frequency range of 500 to 30,000 mc. The system involves the usual heterodyne oscillator principles, plus an automatic beat counting system, plus an electrical, linear, interpolation device.

Defense Electronic Products, Radio Corp. of America, Camden, N. J.
TIME DIVISION MULTIPLEX SYSTEMS, by W. J. Bieganski, L. M. Glickman and others. Final rept. for 1 Jan-31 May 56 on Contract DA 36-039-sc-64459. 29 June 56, 82p. 21 refs. AD-102 296.
Order from LC mi$4.80, ph$13.80 PB 149 102

The purpose of this project was to develop a model time division multiplex system, using circuits and techniques applicable to time division multiplexed communications, which will be more reliable, less complex, lighter, of greater stability, and which may also be produced at reduced cost. The study phase is divided into the following parts: (1) study of time division multiplex systems; (2) general investigation of circuit techniques; (3) investigation of transistor circuits; and (4) investigation of magnetic circuits. The experimental model development (Phase II) is divided into the following parts: (1) final development of circuit blocks; (2) layout and packaging; (3) construction of the models; and (4) final tests.

Directorate of Labs., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ERROR ANALYSIS FOR DETERMINATION OF TARGET POSITION AND VELOCITY FROM TWO OR MORE OBSERVERS, by Edouard E. Perret. June 60, 38p. 1 ref. WADD Technical note 60-70.
Order from OTS $1.00 PB 161 979

If a target is observed from two or more separate points, it may be possible to determine the target's position and motion from the measurements obtained. However, since these measurements contain errors, there will be errors in the determination of the target's position and velocity. This paper investigates the significance of statistical errors of measurement of target position and velocity for any location of the target relative to the observers by the following two measuring systems: (1) System employing angle only information from two observers. (2) System employing range only information from three observers. Gaussian errors with zero mean are assumed throughout. The various errors for each measuring system are first considered individually and then combined. This yields statistical error boundaries in target position which are determined by ellipses for the two dimensional case and by ellipsoids for the three dimensional case. The main axes of the error geometries and their angles relative to some reference are computed and their loci plotted for any target position. (Author)

Electric Storage Battery Co., Yardley, Pa.
INVESTIGATION OF AgO PRIMARY BATTERIES, by P. Ruetschi and R. F. Amlie. Quarterly rept. no. 3, 1 Dec 59-29 Feb 60, on Contract DA 36-039-sc-78319. 31 Mar 60, 21p. 5 refs.
Order from LC mi$2.70, ph$4.80 PB 149 610

The solubility of Ag_2O and AgO in alkaline electrolyte has been studied by a polarographic technique using a rotating platinum electrode. Evidence is presented that AgO in contact with alkaline electrolyte does not dissolve to produce a divalent silver species in solution. Also, the self-discharge of the electroformed AgO plate is nearly the same as for the best chemical AgO sample. (Author) (See also PB 147 974)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
A NEW METHOD OF DRIVING-POINT FUNCTION SYNTHESIS, by Wan Hee Kim. Interim technical rept no. 1 on Contract DA 11-022-ORD-1983. 1 Apr 56, 61p. 41 refs. [OOR rept. 1571:...] AD-91 478.
Order from LC mi$3.90, ph$10.80 PB 150 727

This report released for sale to the public 3 Oct 60.

A new method for synthesizing driving-point functions with passive, linear, bilateral elements in non-series-parallel structures is presented. The method is based on topological analysis and on the analysis of network poles and zeros. By the new method, the driving-point functions which can be synthesized with a minimum number of elements are found, and the minimum number of reactive elements required to realize a minimum function is given. These results extend the relationship of the number of elements in a network realization to the order of the driving-point

function. The synthesis method is reduced to solving simultaneous equations for the value of each element. The minimum function synthesis method is shown to be a modification of Pantell's process.

Electrical Engineering Research Lab., U. of Illinois, Urbana.
ON MINIMAL REALIZATION OF RC TWO-PORTS, by S. L. Hakimi and J. B. Cruz, Jr. Interim technical rept. no. 18 on Contract DA 11-022-ORD-1983. 4 Mar 60, 28p. 5 refs. OOR rept. no. 2207.7-E; AD-238 874.
Order from LC mi$2.70, ph$4.80 PB 150 393

From a given RC-realizable open-circuit voltage transfer function, some lower bounds are obtained for the minimum possible number of elements in the network. In the case of bilinear and biquadratic functions, network realizations have been tabulated which are minimal although not all realizable biquadratic functions are covered. In the case of an n-pole transfer function with symmetrically clustered zeros, a realization involving at most two elements more than the minimum requirement is obtained using Guillemin's parallel ladder procedure. The effects of interchanging the input terminals and interchanging the R's and C's in a network are also considered. (Author)

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
DETECTION OF NON-GAUSSIAN SIGNALS IN GAUSSIAN NOISE, by Richard L. Townsend. Rept. on Contract DA 19-020-ORD-4637. June 60, 12p. 7 refs. Rept. 7967-R-5; OOR rept. no. 2001.4-E; AD-240405.
Order from LC mi$2.40, ph$3.30 PB 150 408

Considerable difficulty is generally encountered when attempting to determine the structure of a likelihood ratio test for the detection of non-gaussian signals in the presence of additive gaussian noise. Consideration is given to the possibility of detecting such signals by sub-optimum means. The performance of a class of suboptimum tests which are obtained by averaging over the signal ensemble the optimum test for each ensemble member is evaluated. Besides having the advantage of being very simple in form, this class of tests compares favorably with the optimum test for a wide range of signals. (Author)

[Electronic Systems Lab.] Mass. Inst. of Tech., Cambridge.
NON-LINEAR ADAPTION IN MANUAL CONTROL SYSTEMS, by Robert W. Roig. Rept. on Contracts NObs-72017 and DA 19-020-ORD-4637. June 59, 87p. 11 refs. Rept. nos. 7420-R-4 and 7967-R-2; [OOR rept. 2001:...] AD-226 293.
Order from LC mi$4.80, ph$13.80 PB 150 405

The human operator, as a feedback control element, has been tested in a simple control system utilizing random input signals from a non-Gaussian process. The rms error performance of the human operator has been evaluated and compared with that obtainable from an optimum linear system. The form of the error response for the human operator and the optimum linear system is also compared. The results indicate that the manual control system produces a mean square error which is comparable to that of a highly constrained optimum linear system. However, the human operator shows a more adaptable control characteristic than the optimum linear system when the form of the error response is compared. The human operator was tested using visual displays of the error signal which allowed him to view a portion of the immediate past history of the error and which showed only the instantaneous value of the error. A comparison of the results show no significant advantage for one display over the other. (Author)

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
OPTIMUM CONTROL SYSTEMS FOR A CLASS OF STOCHASTIC SIGNALS, by Rubert B. Streets, Jr. Rept. on Contract DA 19-020-ORD-4637. Mar 60, 53p. 9 refs. Rept. 7967-R-4; OOR rept. no. 2001.3-E; AD-240 404.
Order from LC mi$3.60, ph$9.30 PB 150 409

The class of stochastic signals considered is composed of data components which are continuous sections of analytic arcs, and of Gaussian noise components. Analytic arcs denote a linear combination of known functions and random coefficients which possess a Gaussian distribution. (Author)

Electronics Research Lab., U. of California, Berkeley.
BEHAVIOR OF A FIELD-SWEPT MASER OSCILLATOR, by J. C. Kemp. Rept. on Contract AF 49(638)102. 19 Apr 60, 31p. 15 refs. Series no. 60, issue no. 275; AFOSR-TN-60-509.
Order from LC mi$3.00, ph$6.30 PB 149 239

Electronics Research Lab., U. of California, Berkeley.
NONLINEAR ANALYSIS OF A TRANSISTOR HARMONIC OSCILLATOR, by D. O. Pederson and R. S. Pepper. Rept. on Contract N7onr-295(29). 15 Oct 59, 25p. 1 ref. Rept. no. 96; Series no. 60, issue no. 255; AD-230 507.
Order from LC mi$2.70, ph$4.80 PB 149 497

The analysis of a tuned-collector transistor oscillator concerns the development of both graphical and piecewise linear techniques for obtaining the composite negative resistance characteristic that is presented to the tank circuit. This is done for the common-emitter connection of the transistor; however, the common-base connection can also be used. With the negative resistance characteristic, conventional phase plane and limit cycle analysis can be used to predict the oscillator output. Higher order effects are inspected, and it is found that the simplifying assumptions made are quite valid. Thus, the second order differential equation provides a good approximation of the system. Experimental results are given that show predicted and observed values are within a few percent for amplitude of oscillation, period of oscillation, and wave shape, i.e., harmonic content. (Author)

Electronics Research Lab., U. of California, Berkeley.
OPERATIONAL ANALYSIS OF FINITE-PULSED SAMPLED-DATA SYSTEMS, by T. Nishimura. Rept. on Contract AF 18(600)1521. 10 May 60, 39p. 9 refs. Series no. 60, issue no. 279; AFOSR-TN-60-510.
Order from LC mi$3.00, ph$6.30 PB 149 092

The theory of the operational analysis of the finite-pulse-width system is developed in this report. The closed-form expression of the response from such system is described by means of several well-known operators such as the z-transform, the modified z-transform and the simple form of the p-transform. Finding the incremental responses and their superposition is the basic principle of the theory and it is also applied to two-sampler systems as well as multi-rate sampling systems. (Author)

Electronics Research Lab., U. of California, Berkeley.
QUARTERLY PROGRESS REPORT. Rept. for 1 July-30 Sep 59 on Contracts N7onr-29529, Nonr-222(53), 222(54), and 222(57). 31 Oct 59, 26p. Series no. 60, issue no. 26; AD-230 521.
Order from LC mi$2.70, ph$4.80 PB 149 874

Contents:
Back-scattering from cones
Scattered fields from anisotropic media
Microwave parametric amplifiers
Ferrite field-displacement device for slot coupling control
Applications of Maxwell's equations
Network theory
Electronic circuits research
Antenna arrays from a data-processing viewpoint
Information theory
Solar radiation studies
Research in high temperature semiconductor devices
Magnetic amplifiers. (See also PB 145 072)

Engelhard Industries, Inc., East Newark, N. J.
INVESTIGATIVE RESEARCH PERTAINING TO CATALYTIC HEATING OF PRIMARY BATTERIES, by Herbert J. Greenberg. Final rept. (including Quarterly rept. no. 2) for 1 May-31 Dec 59 on Contract DA 36-039-sc-78914. [1960] 27p.
Order from LC mi$2.70, ph$4.80 PB 149 611

The technical approach to be followed for a fuel-catalyst program is presented. Ignition of methanol at -40°F without the addition of an external heat source was found to be unattainable. Self sustaining combustion of methanol at -40°F min. was demonstrated, but only with preheating of the fuel-air mixture. Ignition of methane was tried, but required an external heat source also (glow coil), and then was effected only when a temperature of +47°F was reached. (Author)

Feltman Research Lab., Picatinny Arsenal, Dover, N. J.
COMPLIANT ELECTRODES FOR DIELECTRIC MEASUREMENTS, by Andrew R. Blanck. Aug 60, 12p. 4 refs. Technical notes no. FRL-TN-1.
Order from OTS $0.50 PB 161 670

Compliant Electrodes which give improved surface contact were developed. (Compliant Electrodes are electrodes which conform or "comply" to the surface of the test specimen. The surface may be essentially planar or curved.) This technique is simpler than those using the pasted foil, flexible foil, painted, or evaporated electrodes and will give more reproducible results because of the intimate contact with the specimen surface. If a conductive silicone elastomer is used for the electrodes they can be used for measurements from -100° to +400°F. When electrodes of different shapes are required to suit the dimensions of available test material, they may be easily and quickly fabricated in the laboratory. (Author).

General Electric Microwave Lab., Palo Alto, Calif.
MEASUREMENT AND CONTROL OF HARMONIC AND SPURIOUS MICROWAVE ENERGY, by Vernon G. Price. Final rept. Change B for Dec 59-Apr 60 on Contract AF 30(602)1670. 20 May 60, 83p. 22 refs. Rept. TIS R60ELM112-5; RADC TR-60.
Order from LC mi$4.80, ph$13.80 PB 150 281

An experimental harmonic calorimeter was fabricated to measure harmonic powers in waveguides. By measuring the sum of the power levels of the individual waveguide modes at a given harmonic frequencies, one can quickly measure the total power without recourse to mathematical analysis. This simpler measurement method (compared with the probe analysis method) is accomplished at the expense of identification of the individual modal power levels. S-band and L-band model ferrite attenuators were received for test and evaluation. A summary of these tests and the test methods is included. In order to continue the study and investigation of the reduction of spurious outputs in microwave systems, a novel filter arrangement was conceived which makes it possible to achieve a relatively narrow band pass filter characteristic as well as a broad stop band characteristic. A preliminary design for a filter of this type is included. (Author) (See also PB 148 534)

General Telephone and Electronics Labs., Inc., Bayside, N. Y.
STUDY OF NONLINEAR EFFECTS ON SEMICONDUCTIVE MATERIALS, by E. Conwell, V. Fowler, and J. Zucker. Final rept. on Contract AF 19(604)5714. 31 Mar 60, 107p. 15 refs. TR 60-206, 301.4; AFCRC-TR-60-148; AD-239 723.
Order from LC mi$5.70, ph$16.80 PB 149 168

The objectives of this program were to study nonlinearities in conductivity and dielectric constant of silicon and germanium at microwave frequencies, and to determine efficiency of harmonic generation at milli meter and sub-millimeter wavelengths attainable by use of these nonlinearities.

Gilfillan Bros., Inc., Los Angeles, Calif.
INTERROGATOR SET AN/UPX-16. Final rept. on Contract AF 30(602)2054. 12 Apr 60, 29p. RADC rept. no. TR-60-90.
Order from LC mi$2.70, ph$4.80 PB 148 770

The equipment consists of two AN/UPX-4 Interrogators, one modified as a directional channel and the other modified to be a reference channel. The two together

are used to provide both active and passive side-lobe suppression for the Mark X IFF/SIF system. The active technique, known as Interrogation Side-Lobe Suppression (ISLS), minimizes false replies, reduces total aircraft "dead time", and also minimizes actuation of the Aircraft AOC. The passive technique, known as Responser Side-Lobe Suppression (RSLS) minimizes display of signals which are valid replies to other interrogators. The use of these side-lobe suppression techniques results in marked system improvement. (Author)

Haskins Labs., New York.
RESEARCH ON AUDIBLE OUTPUTS OF READING MACHINES FOR THE BLIND, by J. Bastian. Progress rept. no. 4 for 1 July 59-30 June 60 on Contract V1005M1253. [1960] 52p. 1 ref.
Order from LC mi$3.60, ph$9.30 PB 149 881

The basic problems towards which the research has been directed are the formulation and testing of rules for speech synthesis and the study of isolated spoken words with a view to their combination into acceptable sentences. The objective in both cases is an audible output for a reading machine that will be like speech or acceptable as speech.

Hazeltine Electronics Corp., Little Neck, N. Y.
INSTRUCTION BOOK FOR RADAR SAFETY BEACON TEST SET TYPE 2.3NA3. Rept. on Contract NOas-55-438-c. 1 Mar 55, 30 Nov 55, 225p.
Order from LC mi$9.90, ph$34.80 PB 147 959

Radar Safety Beacon Test Set Type 2.3NA3 is a portable, a-c operated instrument, designed to perform rapid pre-flight checks of installed Radar Safety Beacon, Type III, airborne transponders. The following features of these beacons (transponders) are checked simultaneously: (a) transmitter frequency, (b) relative transmitter power output, (c) decoding of interrogations, (d) reply codes, (e) receiver frequency, and (f) relative receiver sensitivity. The results of these checks are simultaneously resolved into a single REJECT or ACCEPT indication on an operating panel meter.

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY, by George Grant, James M. McKendry. Rept. 5 on Human Factors in Maintenance, Contract N61339-330. 4 Apr 60, 25p. 12 refs. Technical rept. NAVTRADEVCEN-330-1
Order from LC mi$2.70, ph$4.80, PB 150 174

Maintainability can be quantitatively defined as the speed with which troubles are detected, localized, and corrected. A minimization of this "downtime" can occur through the use of any number of approaches: (a) improving equipment design, (b) improving technicians' skills via training, and (c) providing more effective maintenance aids, especially trouble-shooting guides. The purpose of the work reported in this summary document was aimed at devising methods for achieving the first goal, which seems to be the most basic of the three mentioned above.

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT I. AN EXPERIMENTAL INVESTIGATION OF EQUIPMENT PACKAGING FOR EASE IN MAINTENANCE, by J. M. McKendry, J. F. Corso and others. Rept. 5 on Human Factors in Maintenance, Contract N16339-330. 4 Apr 60, 123p. 5 refs. Technical rept. NAVTRADEVCEN 330-1, Supplement 1.
Order from LC mi$6.30, ph$19.80 PB 150 175

A preliminary examination of maintenance research showed that human engineering recommendations were primarily restricted to exterior characteristics of equipment. This technical report summarizes the findings of a study which was aimed at attacking the maintenance problem at a more basic level, that of devising equipment packaging philosophies which should decrease fault localization time. Four such philosophies were devised. The "Standard Method" weighed factors such as: heat loss, component and unit size, and component weight, to arrive at a compromise which varied for each equipment made. A "Component Grouping" method placed similar components together. A "Circuit Grouping" method placed similar circuits together. A "Logical Flow" technique employed a modular concept where subdivisions were made when the signal underwent a marked change. (See also PB 150 174)

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT II. SURVEY INFORMATION: (A) DESCRIPTION OF THE TRAINING DEVICE TECHNICIAN; (B) ENGINEERS' ESTIMATES OF CIRCUITS AND SYSTEM MAINTAINABILITY, by J. M. McKendry, G. Grant, and J. F. Corso. Rept. 5 on Human Factors in Maintenance, Contract N61339-330. 4 Apr 60, 111p. 10 refs. Technical rept. NAVTRADEVCEN 330-1, Supplement 2.
Order from LC mi$6.00, ph$18.30 PB 150 176

The survey data obtained from TRADEVMEN included: background and training, work environment, organization of the work group, familiarity and preferences in regard to tests equipments and manuals, troubleshooting techniques, and the relationship between fault localization time and fault correction time. It was found that only the more experienced men knew enough to give accurate preferences about the above categories. For this reason, the data included apply to a more experienced group only. Design and Field Engineers were questioned about system and equipment troubleshooting procedures. Most of this information dealt with specific representative circuits and included such aspects as test point and component location, parameters important in troubleshooting, and the test equipment needed to check these parameters. No significant differences were noted between the replies of field and design engineers. It was also found that both engineers and technicians preferred to use similar procedures in troubleshooting a system. (Author) (See also PB 150 175)

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT III. ANTHROPOMETRY OF ONE HANDED MAINTENANCE ACTIONS, by P. Baker, J. M. McKendry, and G. Grant. Rept 5 on Human Factors on Maintenance, and Contract N61339-330. 4 Apr 60, 39p. 7 refs. Technical rept. NAVTRADEVCEN 330-1, Supplement 3.
Order from LC mi$3.00, ph$6.30 PB 150 177

In examining present and anticipated maintenance tasks, four basic types of dynamic maintenance actions were isolated: (a) the motion required to turn screwdrivers and spintites, (b) the action required to grasp, remove and replace plug-in units, (c) the action required to grasp, turn, and cut with pliers and wirecutters, and (d) the motion required to turn wrenches. The space envelopes required for each of the above actions was determined by a photographic process. Subjects employed in the study included experienced and inexperienced subjects with 95th percentile hand sizes. The dimensions for each envelope were obtained. (A more exact listing of dimensions would also subdivide the last action (d above) according to the main turning axis, i.e., a horizontal or vertical turning axis.) It was found that there seem to be three main factors influencing the size of the space envelope required for a task. The first, and most important, was the type of action required. The second was the size of the component or tool being manipulated, and the third, the tightness of the component mounting socket. (Author) (See also PB 150 176)

HRB-Singer, Inc., State College, Pa.
DESIGN FOR MAINTAINABILITY. SUPPLEMENT IV: MAINTAINABILITY HANDBOOK FOR ELECTRONIC EQUIPMENT DESIGN, by J. M. McKendry, G. Grant and others. Rept. 5 on Human Factors in Maintenance, Contract N61339-330. 4 Apr 60, 384p. 184 refs. Technical rept. NAVTRADEVCEN 330-1-4.
Order from OTS $5.00 PB 161 025

This handbook provides data which should be useful for the designer in improving the maintainability of existing equipment. Greater maintainability can be achieved by the use of any combination of four different approaches: (1) the improvement of technical proficiency of repairmen by training, (2) the improvement of maintenance aids available to the technician, (3) the improvement of equipment design, and (4) the improvement of the layout and arrangement of the work situation. The third approach which is the main approach covered in the handbook is described in detail. (See also PB 150 177)

Hughes Aircraft Co., Culver City, Calif.
ARBITRARILY POLARIZED PLANAR ANTENNAS, by F. J. Goebels, Jr. and K. C. Kelly. Rept. on Contract AF 33(600)31582. July 59, 29p. 6 refs. Technical memo. no. 592.
Order from LC mi$2.70, ph$4.80 PB 148 275

This report describes the analysis and design of a class of two-dimensional, planar antennas which can radiate and receive constant shape pencil beams with arbitrary elliptical polarization (including the special cases of linear polarization and polarization in either circular sense) by a simple adjustment in the feed circuit. Such radiators are termed arbitrarily polarized antennas. Their basic radiating element is an annular slot whose broadside radiation pattern displays 8 db sidelobes in all ϕ planes. Arraying such elements readily produces lowered sidelobes. Standing-wave and traveling-wave array designs are discussed and results of experiments conducted at X-band are given. (Author).

Hughes Aircraft Co., Culver City, Calif.
TWO-DIMENSIONAL MODEL FOR THE EVALUATION OF RADOME ANALYSIS APPROXIMATIONS, by Alexander D. Jacobson. Rept. on Contract AF 33(038)28634. June 58, 62p. 11 refs. Technical memo. no. 580; AD-207 279.
Order from LC mi$3.90, ph$10.80 PB 147 507

Several methods in common use for analyzing antenna-radome pointing errors involve two major assumptions: (1) the electric field existing in the presence of the radome on a surface lying between the antenna and the radome, can be approximated by the electric field measured over the surface in the absence of the radome; and (2) the interior field can be transmitted through the radome wall using plane-wave plane-sheet transmission coefficients. The validity of these assumptions is evaluated by employing them to determine the field of a 2-dimensional model and comparing the results to the exact fields of this system.

Illinois U., Urbana.
HIGH-TEMPERATURE ELECTRICAL INSULATING INORGANIC COATINGS ON WIRE, by David L. Wilcox, Clifton G. Bergeron and others. Rept. for Feb 59-Feb 60 on Electrical and Electronic Materials, Contract AF 33(616)3943. May 60, 75p. 5 refs. WADC Technical rept. 58-12; Part III.
Order from OTS $2.00 PB 161 954

This report discusses the work on flexibility of coated wire, coating trials on clad copper wires, firing procedure for two coats of 58C on copper wire, vitreous silica and boron nitride mill additions to glass coating 58C, and vitreous coatings sheathed with organics. Also, test data were obtained on high-temperature insulated wire supplied by various manufacturers. A heat treatment of the coating increased coating flexibility. Sheathing of vitreous coatings with organics showed promise as a method of retaining the flexed vitreous coating on the wire. (Author) (See also PB 151 943)

International Business Machines Corp., Kingston, N. Y.
THIN FILM CIRCUIT FUNCTIONS, by H. J. Beatty, W. N. Carroll and others. Quarterly progress rept. no. 1, 1 Aug-31 Oct 59, on Contract DA 36-039-sc-84547. [1959] 72p. 10 refs. AD-232 959.
Order from LC mi$4.50, ph$12.30 PB 150 807

This report released for sale to the public 13 Oct 60.

The initial effort is presented of a long range research and development program on the formation of microminiature functional thin film circuit units, of essentially planar form factor, which will provide a broad

range of basic electronic functions for Army electronic equipment. A functional thin film circuit is an integrated combination of single and/or multi-layer films which is capable of transforming a given form of input energy into a desired form of output energy (e.g. providing a specific electronic function) when connected to associated electronic circuitry. The ultimate objective of the long range program is a circuit fabrication method which, in conjunction with appropriate optimum integration techniques, will make possible the reduction in size of electronic equipment by several orders of magnitude over what is attainable with existing methods (including the Army Micromodule technique with its current types of microelements). (Author)

International Business Machines Corp., Kingston, N. Y.
THIN FILM CIRCUIT FUNCTIONS, by H. J. Beatty, W. N. Carroll and others. Quarterly progress rept. no. 2, 1 Nov-31 Jan 60, on Contract DA 36-039-sc-84547. [1960] 48p. 3 refs. AD-235 639.
Order from LC mi$3.30, ph$7.80 PB 150 808

This report released for sale to the public 13 Oct 60.

The following information is given on preliminary circuit selections: bulk-component design of IF and RF amplifiers as related to difficulty in fabricating high-valued thin film inductors; the film layout of the OR switching circuit; anticipated parts densities; a description of artwork used in photo-etch mask fabrication; results of initial circuit fabrications and difficulties encountered. A thermo-compression bonding machine, results achieved, and ease of bonding with three metallic systems (copper, aluminum, and gold) are described. Glass has been selected as substrate material on the basis of S_iO undercoating studies. However, some circuits will be deposited on sapphire. Also discussed are fabrication equipment and multilayering techniques, including topological factors, materials selection, substrate processing and post-fabrication processing; plans for environmental tests and surface protection of passive elements and chip-type active elements are presented. Experimental data are presented concerning vapor-deposition growth of single-crystalline semiconductor layers by the disproportionating reaction of S_iI_2. Also described is a method of approximating impurity concentrations in samples from resistivity measurements over a temperature range. (Author) (See also PB 150 807)

International Telemeter Corp., Los Angeles, Calif.
HIGH-SPEED ELECTRONIC CIRCUITS. Technical rept. no. 23 [on Contract AF 30(602)1566]. 20 Nov 57, 116p. RADC-TN-58-13; AD-148 546.
Order from LC mi$6.00, ph$18.30 PB 147 803

The following high speed electronic circuits are discussed: scanner circuit, high-speed logic circuits, flip flops, flip-flop gating circuits, buffers, special gating boards, super cathode follower, high-speed clocks, low-to-high speed clock, power supplies, power supply sequencer, and low- and high-speed board testers.

John Hopkins U., Baltimore, Md.
REPRESENTATION AND ANALYSIS OF SIGNALS. PART V. FLOW-GRAPH REPRESENTATION OF SYSTEMS AND SYSTEM DYNAMICS, by W. H. Huggins. Rept. on Contracts AF 19(604)1941 and Nonr-248(53). 15 Nov 59, 97p. 10 refs. AFCRC-TN-59-971; AD-235 141.
Order from LC mi$5.40, ph$15.30 PB 148 301

Flow-Graph Representation of Systems: The flow-graph representation which may be used to express and investigate the relations between the signals (i.e. observables) of a system is discussed. For linear and constant-parameter systems, the flow-graph can be manipulated to solve the simultaneous equations that describe the system. The flow-graph leads to the programming of a computer and provides a technological esperanto which is well adopted to the needs of systems modeling. System Dynamics: The extension of the flow-graph concepts to dynamical systems is accomplished by introducing the exponential signal, A exp(st), which is characteristic of all linear, stationary systems. The concepts, usually obtained by application of the Laplace transform, are shown to emerge naturally as a consequence of the use of this characteristic signal to describe linear stationary operators. This approach offers an enhanced appreciation of the ties between signals and systems. Application to both deterministic and stochastic systems is illustrated. (Author) (See also PB 137 788)

Land-Air, Inc., Holloman, N. Mex.
PHASE LOCK TRACKING FILTER, by W. M. Riker and Claude Rudy. Final rept. (Revised) on Contract DA 29-040-ORD-1010. Nov 58, rev. Nov 59, 167p. 1 ref. LA-59-04, formerly LA-58-16 dated Nov 58; AD-231 347.
Order from LC mi$7.80, ph$25.80 PB 147 575

The Phase-Lock Tracking Filter is a closed-loop system which generates a signal, and phase-compares it with data containing the desired Doppler signal, then evaluates it through bandpass selection. The system accepts real-time or recorded real-time data over a signal intelligence range of 250 cps to 100 kc at a minimum level of .02 volts rms having a noise-to-signal content of no more than 16 db. Analog outputs of velocity, acceleration, and correlation are provided. Single-frequency outputs of the restored Doppler signal and a biased frequency containing the restored Doppler are available for digital operations, and for photographic recordings utilizing the cathode-ray oscillograph. The Model 1 is housed in a de luxe desk-type console, equipped with controls and meters which provide quick-look information. The Model 4 is housed in a standard equipment rack. Both models utilize improvements which became feasible after a trial period of operational use in the field. (Author)

Martin Co., Baltimore, Md.
RADIOISOTOPE TUBE HEATER. Rept. on Thermionics and Solid State Electronic Technology, Contract AF 33(616)6325. Mar 60, 66p. WADD Technical rept. 60-246.
Order from OTS $1.75 PB 171 015

The feasibility of heating a vacuum tube cathode using a radioisotope-fueled heat source was demonstrated when emission and amplification were obtained using a 200-curie Polonium-210 heat source, encapsulated in a double stainless steel container, to heat the cathode of a Type X-766 vacuum tube built by Eitel-McCullough, Inc. The tube and heat source were assembled together and provided with a manual temperature control system. Operation of the temperature control system proved that the decreasing heat output of a decaying radioisotope can be controlled to obtain constant cathode temperature. Tube characteristics were obtained using an electrical simulated heater prior to final tests with the radioisotope fuel source installed. No correlation was obtained between the characteristics obtained with the two heating systems because the maximum cathode temperature achieved using the radioisotope was 640°C, while the cathode temperature for the electrically heated tests was 700°C. Various tube configurations were tested prior to final tests, and the conceptual design of an operational tube is presented. (Author)

Mauch Labs., Inc., Dayton, Ohio.
THE DEVELOPMENT OF A READING MACHINE FOR THE BLIND, by H. A. Mauch. Summary rept. for 1 July 59-30 June 60 on Contract V1005 M-1943. 30 June 60, 11p.
Order from LC mi$2.40, ph$3.30 PB 150 140

Scanning optimization studies and photocell studies support the expectation of eventual attainment of recognition operation, using a "spelled speech" output. Basic solutions were found for the identification of characters other than small letters and of various types of print. Code studies for the word synthesizer resulted in the adoption of a 6-bit code which follows closely the principles of conventional codes. Only 48 of the possible 64 combinations need be used. This will keep the size and weight of the machine within acceptable limits. Important improvements were introduced regarding matrix design, word separation techniques, control relay circuitry, and reliability of mechanical operation. Functional models of the scanning device including opaque projector and display panel, as well as of the word synthesizer, were built and demonstrated.

Mellon Inst., Pittsburgh, Pa.
HIGH TEMPERATURE PRINTED CIRCUITRY. Final rept. for 1 Oct 56-30 Apr 60, on Computer Components Fellowship no. 347, Contract AF 19(604)1959. 1 June 60, 25p. 3 refs. AFCRC-TR-60-154.
Order from LC mi$2.70, ph$4.80 PB 149 147

The various contractually-assigned Fellowship objectives are presented together with a brief summation of the successive accomplishments in each research area over the entire contract term. In every case, reference is made to the specific scientific quarterly report in this series in which the cited investigations may be found. (Author) (See also PB 149 146)

Melpar, Inc., Falls Church, Va.
DEVELOPMENT OF STANDARDIZED MODULES FOR AVIONICS EQUIPMENT. Final rept. on N62269-513. Rept. on TED Proj. no. ADC AV44005. 24 Sep 59, 75p. 27 refs. Rept. no. NADC EL5988. 27 refs. Rept. no. NADC EL-5988.
Order from LC $4.50, ph$12.30 PB 152 021

This report released for sale to the public 11 Oct 60.

Melpar, Inc., Falls Church, Va.
GENERATION OF MULTIPOLARIZED ELECTROMAGNETIC WAVES FOR ECM APPLICATIONS, by Edward F. Henry. Scientific rept. no. 1 on Contract AF 19(604)4988. Apr 60, 36p. 3 refs. AFCRC-TN-60-592.
Order from LC mi$3.00, ph$6.30 PB 149 751

Two methods are described for generating a multipolarized wave for ECM jamming purposes. Both methods generally involve the excitation of two orthogonally oriented linear antennas at slightly different frequencies. Discussions and mathematical analyses of the performances of both systems are presented, and some experimental data is included. General design considerations are also outlined. Curves of theoretical relationships are plotted to illustrate performance characteristics. (Author)

Michigan U. Research Inst., Ann Arbor.
DESIGN CONSIDERATIONS FOR A CAPACITANCE-MODULATED VFO, by T. W. Butler, Jr. Technical memo. no. 60 on Contract DA 36-039-sc-63203. Sep 58, 21p. 3 refs. 2262-159-T; AD-208 106.
Order from LC mi$2.70, ph$4.80 PB 147 607

The use of ferroelectric capacitors in the design of a band switching capacity-modulated VFO which will meet FCC specifications regarding Narrow-Band frequency modulation (NFM) is presented. The chief advantage of NFM is that it reduces or eliminates certain types of interference to broadcast reception and is quite simple and inexpensive to construct using capacitance-modulation techniques. (Author)

Michigan U. Research Inst., Ann Arbor.
ELECTRIC-TUNED CAPACITY-MODULATED VHF OSCILLATOR, by T. W. Butler, Jr. Technical memo. no. 59 on Contract DA 36-039-sc-63203. Aug 58, 25p. 2 refs. 2262-186-T; AD-208 108.
Order from LC mi$2.70, ph$4.80 PB 147 606

A method of utilizing the voltage tuning characteristics of ferroelectric capacitors in an electric tuned capacity modulated VHF oscillator is described. The oscillator employs titanate ceramic capacitors as both the tuning and modulating elements. The capacity of the tuning elements is varied by changing the electric field applied to the capacitors. The oscillator may be designed to work in the VHF and UHF regions where reactance-tubes and phase modulation methods are unwieldy. This electric-tuned capacity-modulated VHF oscillator is the result of a development program designed to indicate the direction engineers can take in developing a voltage tunable frequency modulated oscillator suitable for operational use. (Author)

Microwave Associates, Inc., Burlington, Mass.
INVESTIGATION OF DUPLEXING TECHNIQUES AT HIGH DUTY CYCLE CONDITIONS, by Lawrence Gould. Quarterly progress rept. no. 6, 1 Jan-31 Mar 60, on Contract DA 36-039-sc-78233. [1960] 17p.
Order from LC mi$2.40, ph$3.30 PB 149 609

The leakage power and recovery time characteristics of crystal protector TR tubes designed for high duty cycle duplexers have been investigated. The results show that the leakage power is strongly dependent on receiver mismatch. The role of the various elements of the tube in controlling leakage power and recovery time is described. Preliminary results on a semiconductor switch yield a switching ratio of 0.6 db to 30 db with variation of voltage from -6v to +1 v. (Author). (See also PB 146 796).

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
REFLEX MULTIPACTOR EFFECT, by B. Epsztein. Rept. on Contract AF 18(600)1505. 22 Sep 59, 18p. Research rept. R-763-59; PIB-691; AFOSR-TN-59-1103 AD-228 708.
Order from LC mi$2.40, ph$3.30 PB 149 997

This paper is concerned with the theoretical study of a new type of multipactor which can take place on a single surface in the presence of a tangential d. c. magnetic field. The analysis shows that the presence of this effect depends only on the ratio of the cyclotron frequency corresponding to the applied magnetic field to the operating frequency, once a threshold for the r. f. field is reached. The value of this threshold depends on the secondary emission properties of the surface. Conditions for stable reflex multipactor are given. (Author)

Microwave Research Inst., Polytechnic Inst. of Brooklyn, N. Y.
SYNTHESIS AND APPLICATIONS OF LINEAR AND NONLINEAR NETWORKS, by A. B. Giordano. Final rept. for 1 Feb 54-31 May 59 on Contract Nonr-839(05). 15 June 59, 31p. 3 refs. Rept. no. R-747-59; PIB-675; AD-220 686.
Order from LC mi$3.00, ph$6.30 PB 147 612

Details are presented of accomplishments relating to network analysis and synthesis, applications of magnetic amplifiers, nonlinear electronic circuits, and information-networks, including staff and special reports issued. (Author)

National Bureau of Standards [Washington, D. C.].
PROJECT TINKERTOY: A BUREAU OF AERONAUTICS INDUSTRY PREPAREDNESS MEASURE. 30 June 52, declassified, 54p. 4 refs.
Order from LC mi$3.60, ph$9.30 PB 149 618

This report released for sale to the public 23 Aug 60.

The code name TINKERTOY has been given to a system of modular design of electronic equipment especially adaptable to mechanized production. The TINKERTOY System is one of a number of possible embodiments of the building-block principle of construction whereby a variety of complicated electronic equipments may be assembled from a number of small standardized units. Each such unit, or module, consists normally of an electron tube and its associated passive components.

Naval Research Lab., Washington, D. C.
LUMINANCE REQUIRED OF OPAQUE AND TRANSPARENT CATHODE-RAY-TUBE PHOSPHORS, by R. H. Brown. 19 Aug 60, 9p. 10 refs. NRL rept. 5504.
Order from LC mi$1.80, ph$1.80 PB 146 610

Detection and recognition of objects presented on intensity-modulated screens depend on human properties of luminance discrimination and on electronic parameters of the display. An analysis has been made of the human requirements in terms of the variation in the incremental luminance of a signal as a function of the background luminance, and the minimal luminance of a signal for a radar display was derived utilizing assumptions based on state-of-the-art considerations regarding electronic parameters. The theoretical minimal luminance required of the conventional opaque phosphors, with and without circular-polarizing filters, and of the recently developed transparent phosphors were compared with the luminous output currently available. It was determined that at present the opaque phosphor in conjunction with a circular-polarizing filter provides the most visible signal when there is considerable illumination on the display. It seems likely, however, that with further development and by careful choice of the electronic parameters the low available luminance of the transparent phosphors may be increased enough to provide the most visible signal, since the luminance required is less than is required on the opaque phosphors. (Author)

Naval Research Lab., Washington, D. C.
PARASITIC SPIRAL ARRAYS, by R. M. Brown, Jr. and R. C. Dodson. Interim rept. 15 Aug 60, 39p. 6 refs. NRL rept. 5497.
Order from LC mi$3.00, ph$6.30 PB 146 394

The radiation pattern of an array of circularly polarized elements can be scanned by a mechanical rotation of the elements, since the element phase is a function of orientation. This principle has been used in the design of two different arrays of Archimedean spirals, one a "parasitic lens array" and the other a "parasitic reflector array." The lens consists of two arrays of spirals mounted on opposite sides of a conducting plane, each spiral on one side being connected by a transmission line to a corresponding spiral on the opposite side. A feed horn is used to illuminate one of the arrays; the energy received by this array passes through the ground plane via the transmission lines and is reradiated by the spirals on the far side. If the elements are rotated to particular orientations, the incident spherical wave can be focused, and, further, the beam can be scanned if the spirals are rotated properly. The spiral reflector is a single array (using no transmission lines) mounted above a ground plane and, like the lens, is illuminated by a feed horn. It has the same focusing and scanning properties as the lens. Neither array is limited to circular polarization. With a combination of right- and left-hand elements, linear polarization can be used. Twenty-element lenses (two by ten) and 100-element reflectors (ten by ten) have been built and the results have verified the predicted performance. (Author)

Naval Research Lab., Washington, D. C.
A TARGET SIMULATOR, by A. J. Stecca, N. V. O'Neal, and J. J. Freeman. Interim rept. 9 Feb 56, declassified 2 Oct 57, 20p. 10 refs. NRL rept. 4694.
Order from LC mi$2.40, ph$3.30 PB 150 587

This report released for sale to the public 11 Oct 60.

A radar target simulator for quantitative analysis of target noise is described and its correspondence with theory analyzed. The basic idea is the utilization of suitable voltages developed by synchro generators to represent the reflections from a complex target. Experiments to determine target noise characteristics as a function of target reflectivity distribution, target motion, and steady-state tracking error are described. It is shown that the total noise power is independent of target motion, whereas both tracking error and reflectivity distribution and target motion on the noise spectrum is exhibited, increasing rates of target rotation cause the greatest redistribution of the noise power from the low-frequency region to higher frequencies. (Author)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY, by J. W. Davisson, Joseph Pasternak and others. Status rept. no. 5, Aug 60, 64p. NRL memo. rept. 1089.
Order from OTS $1.75 PB 161 977

Progress continues to be good on thermoelectric materials development. Higher efficiencies continue to be achieved both in materials for Peltier cooling and for power generation, with no indication of reaching a point of diminishing returns. Particularly encouraging are the early results from high energy radiation damage studies. Two studies have progressed to the point where at least preliminary results can be evaluated. The prospects for useful military applications of thermoelectric systems now appear very good. A substantial number of the thermocouple elements exceeded design hopes in efficiency and power output though the average performance of the production runs of elements are considerable lower. Development programs and feasibility studies are in various stages of progress covering a wide range of power levels. The most difficult measurements are those of thermal conductivity, especially at high temperature. In the appendix a discussion on the methods used for measuring thermal conductivity is presented. (See also PB 147 307)

Naval Research Lab., Washington, D. C.
THERMOELECTRICITY ABSTRACTS. Bibliography no. 4, Aug 60, 94p. 2092 refs.
Order from OTS $2.25 PB 161 714

This bibliography includes current periodicals and research reports received in the Library of the U. S. Naval Research Laboratory and the following index and abstract journals: Abstracts Journal, Metallurgy (USSR); Applied Mechanics reviews; Applied Science and Technology; ASM Review of Metal Literature; Battelle Technical Review; Bell Telephone Laboratories. Technical Information Libraries. Index to Current Technical Literature; Ceramic Abstracts; Chemical Abstracts; Dissertation Abstracts; East European Accessions Index; Engineering Index; Institute of Radio Engineers. Proceedings; Instrument Abstracts; Metallurgical Abstracts; Monthly Index of Russian Accessions (Library of Congress); Nuclear Science Abstracts; Readers Guide to Periodical Literature; Science Abstracts; Semiconductor Abstracts; Technical Abstract Bulletin (ASTIA); Technical Translations; U. S. Government Research Reports (OTS). (See also PB 161 301)

Navy Underwater Sound Lab., Fort Trumbull, New London, Conn.
EFFECTS OF RADIATION IMPEDANCE VARIATION ON SONAR TRANSDUCER PERFORMANCE IN A LARGE ARRAY, by Ralph S. Woollett. 27 July 59, 25p. 6 refs. USL Research rept. no. 428; AD-226 248.
Order from LC mi$2.70, ph$4.80 PB 150 291

The transducer elements in a large array have different radiation impedances because of the acoustic interaction effects among the elements. The characteristics of the transducer element which are of operational interest, such as power capacity, efficiency, phase shift, and input impedance, depend on radiation impedance and hence are different for different elements. In this report equations relating these performance factors to radiation impedance are given for a simple piezoelectric type of transducer. Numerical results are presented for an array of identical transducer elements of this class, using radiation impedance data which were recently calculated for a large spherical array of pistons. The effects of the radiation impedance variation on array performance were judged moderate enough to be accommodated without much change in conventional practices. (Author).

New York U. Coll. of Engineering, N. Y.
EVALUATION AND OPTIMIZATION OF DIGITAL COMMUNICATION SYSTEMS, by Leonard C. Schwartz. Final rept. on Contract AF 19(604)1964. 14 Feb 60, 13p. 4 refs. AFCRC-TR-60-114; AD-234 741.
Order from LC mi$2.40, ph$3.30 PB 148 249

The work under this contract on the evaluation of digital communication systems and their optimization under practical criteria and constraints is summarized. The topics mentioned are the general theory of digital communication systems with fading and interference in both direct and feedback channels; experimental null reception systems; the extension of null reception to binary communication systems employing envelope detection, including FSK; self-synchronizing systems and; signal-to-noise ratio and channel reliability estimation. Possible future research investigation is also discussed. (Author) (See also PB 142 381)

New York U. Coll. of Engineering, New York
OPTIMUM TRANSMISSION OF CONTINUOUS SIGNAL OVER A SAMPLED DATA LINK, by S. S. L. Chang. Rept. on Contract AF 49(638)586. June 60, 12p. 4 refs. Technical rept. 400-11; AFOSR-TN-60-492; AD-239 440.
Order from LC mi$2.40, ph$3.30 PB 148 945

A method for simultaneous optimization of the presampling filter and post sampling filter in a sampled

data link is derived together with an equation for evaluating the mean square error. These equations are simple and easy to use, and the method has been illustrated by applying it to a typical design problem.

New York U. Coll. of Engineering, N. Y.
A REGENERATIVE NON-LINEAR FEEDBACK SYSTEM, by Paul E. Fleischer. Rept. on Contract AF 49(638)586. May 60, 26p. Technical rept. 400-10; AFOSR-TN-60-433. AD-239 439.
Order from LC mi$2.70, ph$4.80 PB 148 944

A feedback system proposed for reducing the effect of a non-linear plant on system performance is investigated. The feedback system operates by comparing the actual output with the desired system output (internally generated) and using this difference as an actuating signal. It is shown that the arrangement, while of novel configuration, is completely equivalent to a single loop feedback system. A typical system is investigated to provide an illustration of the conclusions drawn from this study.

Ordnance Research Lab., Pennsylvania State U., University Park.
A MINIATURE LOW-FREQUENCY SELECTIVE AMPLIFIER, by Wesley Grant Houser. Rept. no. 47 on Contract NOrd-16597. 2 Jan 59, 66p. 11 refs. AD-211 718.
Order from LC mi$3.90, ph$10.80 PB 150 298

Theoretical and experimental investigations reveal that a selective amplifier having a center frequency in the 2 to 15 cps range and a bandwidth less than 10 per cent of the center frequency can be constructed by using a transistor amplifier and a parallel-T feedback network. The circuit, excluding power supply, can be confined to a space measuring 3" by 2 1/4" by 1". The transistor amplifier requires current, as well as voltage, feedback. The parallel-T network is, therefore, required to operate under finite loading. The loading effects are: (a) a positive shift in center frequency, and (b) an increase in bandwidth. The derived equations are able to predict these effects within 2.6 per cent in center frequency and within 16 per cent in bandwidth. (Author)

Pennsylvania State U., University Park.
PROPAGATION DISTORTION OF BANDS OF LARGE-AMPLITUDE ACOUSTIC NOISE. I. THEORETICAL ANALYSIS OF THE PLANE WAVE CASE, by Wayne A. Burnett and Eugene Ackerman. Rept. on Generation, Propagation, Action, and Control of Acoustic Energy, Contract AF 33(616)2772. May 60, 55p. 6 refs. WADD Technical rept. 60-232.
Order from OTS $1.50 PB 171 021

The problem of the propagation of finite amplitude sound waves from a noise source is considered. After a review of the history of the problem, second order techniques are developed and applied to the problem of narrow bands of noise, less than an octave wide at the generator. Five cases of qualitatively different propagation behavior can be distinguished depending on the ranges of frequencies and sound pressure level. For three of the five cases the second order techniques developed are adequate. Unsuccessful attempts at more general solutions are briefly summarized in the appendix, along with suggestions for extending the analyses and increasing the validity of the final solutions. (Author)

Philco Corp., Lansdale, Pa.
NUCLEAR RADIATION RESISTANT POWER TRANSISTORS, by G. F. Watson. Quarterly progress rept. no. 1, 15 May-15 Aug 59, on Contract DA 36-039-sc-78307. [1959] 38p; AD-229 893.
Order from LC mi$3.00, ph$6.30 PB 149 000

Preparations for nuclear irradiations were made. The nuclear reactor at the MIT reactor center was selected as the radiation source. The surface barrier transistor dosimeter technique was used to calibrate the reactor. It was found that exposure in core tube 3GV6 for periods of 1.8 min and 18 min will provide accumulated dosages of 10^{13} and 10^{14}NVT, respectively. Large-area jet etching techniques advanced to the stage where a cabinet model jet etcher was constructed and put in operation. Emitter pits 95 mils diam and collector pits 115 mils diam were etched with this system. The machine incorporates a new illumination technique. An electrochemical jet plating machine, for the formation of emitter and collector electrodes, is now being constructed. The feasibility of forming emitter and collector electrodes by evaporation techniques is being studied. Indium electrodes as large as 100 mils diam were evaporated onto the surface of large unetched diffused blanks. Satisfactory micro alloying was obtained in units heated to 200°C with an indium pellet placed on the evaporated electrode. (Author)

Philco Corp., Philadelphia, Pa.
RESEARCH ON HIGH-TEMPERATURE SWITCHING DEVICES, by E. Zimmerman. Quarterly status rept. no. 4, 1 Feb-30 Apr 60 (Final technical rept. 1 May-30 Apr 60) on Contract AF 19(604)5719. June 60, 38p. 3 refs. Philco no. H-2227-F; ERD-TR-60-167.
Order from LC mi$3.00, ph$6.30 PB 149 832

The object was to conduct a theoretical and experimental investigation of semiconductor switching devices capable of high-temperature (150°C or more) performance, and comparable or superior at low and medium temperatures to existing devices. The wide-gap material GaAs was used initially in analog type, subsequently in bipolar transistor structures, and finally in tunnel diodes. Single-crystal GaAs was grown by horizontal zone-melt techniques. Two main purification methods were investigated: reaction conditions were held constant while element purification procedures were varied; a standard purification procedure was used to study probable contamination from boat materials. Two diffusion methods - box diffusion and sealed-tube diffusion - were studied as techniques for forming junctions and for converting crystals to the desired type and resistivity. Three bipolar transistor structures were evaluated: the homogeneous base NPN and PNP transistors, and mesa NPN transistor. Techniques were developed that yielded high-frequency GaAs tunnel diodes with an f_{MAX} of 3.5 Gc and a potential f_{MAX} of 10 Gc.

Pickard and Burns, Inc., Needham, Mass.
INTERFEROMETER DEVELOPMENT, by John E. Walsh and Hans E. Band. Final rept. on Contract AF 19(604)5435. 29 Feb 60, 74p. 46 refs. P&B Pub. no. 602; AFCRC-TR-60-120.
Order from LC mi$4.50, ph$12.30 PB 148 952

An investigation has been made of the application of correlation techniques to the controlling of multi-element antenna patterns and the enhancement of the signal-to-noise ratio of signals derived from such systems. The primary objective is the production of single-lobed patterns of high resolution using a minimum number of antenna elements. One of the simplest configurations involves two linear arrays of fixed lengths and phase center spacing. The element spacing of the two arrays differs, but exceeds one wavelength. This results in a loss of gain over that of a closely spaced, non-ambiguous array, but allows reduction of the number of elements. Correlation of the added output of one array with that of the other will reduce all major lobes but one, provided only one signal of a given frequency is incident on the antenna system. The correlator also reduces incident noise especially if an additional fixed time delay is introduced between the additive array signals prior to correlation. An attempt has been made to produce patterns by multiplication of signals from a continuous aperture antenna, with the sum of the outputs of individual array elements. For the purposes of drift-free multiplication, amplitude modulation is imposed on the RF signal, preferably at the transmitter. The multiplier is followed by an audio filter tuned to the modulation frequency, from which the desired product signal is obtained.

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by R. Glicksman. Quarterly rept. no. 1, 15 June-15 Sep 58, on Contract DA 36-039-sc-78048. [1958] 52p. 8 refs.
Order from LC mi$3.60, ph$9.30 PB 150 579

This report released for sale to the public 12 Oct 60.

The performance characteristics of A-size Mg $MgBr_2$ m-dinitrobenzene dry cells are compared with those of comparable size magnesium and zinc-manganese dioxide cells. The m-dinitrobenzene cells give more hours of service to 0.90 volt than the manganese dioxide cells over the entire range of discharge tests. On the basis of watt-minute capacity per unit of volume, they are superior to the zinc-electrolytic MnO_2 cells at all but low power output levels but are inferior to the magnesium-African MnO_2 cells. On a weight basis, the organic cells are superior to the zinc-electrolytic MnO_2 cells over the entire range of power output levels, and have a greater watt-minute/g capacity than the magnesium-MnO_2 cells at power outputs greater than 15 milliwatts. The use of a mercurous bromide inhibitor in AA-size Mg| $MgBr_2$ | m-dinitrobenzene cells has resulted in a 25% improvement in cell capacity at low current drains. Capacities of 75 watt-hours/lb have been obtained from these cells. Half-cell potential studies of various heterocyclic nitro compounds indicate that the nitropyridine compounds show promise for use as cathode materials in primary cells because of their high-cathode potentials and efficiencies. (Author)

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen and R. Glicksman. Quarterly rept. no. 2, 15 Sep-14 Dec 58, on Contract DA 36-039-sc-78048. [1958] 58p. 19 refs.
Order from LC mi$3.60, ph$9.30 PB 150 580

This report released for sale to the public 12 Oct 60.

The effect of various ratios of Cabot and Darco G-60 blacks on the performance of A-size Mg/$MgBr_2$/m-Dinitrobenzene cells was studied. It was found that the maximum theoretical cell capacities were obtained at m-DNB/Cabot ratios of 2.1:1 (218 Amp-Min), and m-DNB/Darco ratios of 1.1:1 (196 Amp-min), assuming a 65% Mg efficiency. Based on actual performance data, optimum experimental capacities were obtained at ratios of 1.5 to 2:1 for the Cabot and 0.3-0.5:1 for the Darco blacks. The effect of mercurous salts in the electrolyte continued to be beneficial especially at low current drains. A-size Mg/$MgBr_2$/m-DNB cells made with this inhibitor gave 15-20% more hours of service on 166 2/3-ohm continuous discharge tests than comparable cells containing only a chromate inhibitor. Shelf-life data obtained from AA- and A-size magnesium dry cells containing various aromatic dinitrobenzene and various nitropyridine and nitroquinoline compounds as cathodes, indicate a favorable three month shelf-life for these dry cells. Electrochemical studies of various dinitropyridine compounds are presented in addition to half-cell potential data for various aromatic hydroxy compounds. For the latter compounds, the effect of such factors as group substitution, aromaticity, and pH on the operating potential and coulombic capacity are discussed. The use of these compounds as anode materials in galvanic cells is also considered. (Author) (See also PB 150 579)

Radio Corp. of America [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen and R. Glicksman. Quarterly rept. no. 3, 15 Dec 58-14 Mar 59, on Contract DA 36-039-sc-78048. [1959] 56p. 12 refs.
Order from LC mi$3.60, ph$9.30 PB 150 581

This report released for sale to the public 12 Oct 60.

Studies of the effect of water on cell performance were made with A-size Mg/$MgBr_2$/m-DNB cells wherein the m-DNB/carbon black ratio was held constant while the H_2O/m-DNB ratio was varied. For these cells, the cathode efficiencies were found to increase with increasing H_2O/m-DNB ratios at the low ratios and to assume more constant values at the high H_2O/m-DNB ratios. A comparison of Mg/$MgBr_2$/m-DNB and Mg/$Mg(ClO_4)_2$/m-DNB dry cells indicates that on heavy drain (16 2/3-ohm) tests the perchlorate cells are superior, however on low drain (166 2/3-ohm) tests they do not perform as well as the cells with a magnesium bromide electrolyte. A consideration of alternative designs for the conventional round Mg/$MgBr_2$/m-DNB cell indicates that greater performance gains can be obtained with flat type cells rather than with a round "inside-out" type of cell. Half-cell potential and experimental dry cell data of various nitropyridine compounds are presented in addition to half-cell potential data for various aromatic amine and aminophenol compounds. For the latter compounds, the effect of such

factors as group substitution, aromaticity, and pH on the operating potential and coulombic capacity are discussed. The use of these compounds as anode materials in galvanic cells is also considered. (Author) (See also PB 150 580)

Radio Corp. of America, [Somerville] N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AT THE ACTIVE COMPONENTS, by J. B. Eisen and R. Glicksman. Quarterly rept. no. 4, 15 Mar-14 June 59, on Contract DA 36-039-sc-78048. [1959] 53p. 6 refs. AD-226 587.
Order from LC mi$3.60, ph$9.30 PB 150 582

This report released for sale to the public 13 Oct 60.

A study of the effect of various high overvoltage metal chromates in the cathode mix on the cell performance of Mg/$MgBr_2$/m-DNB cells indicates performance gains may be obtained with the use of Hg_2CrO_4 and $ZnCrO_4$. Additional studies dealing with the use of a $Mg(ClO_4)_2$ electrolyte in organic cells shows the optimum electrolyte concentration in Mg/$Mg(ClO_4)_2$/m-DNB cells to be 0.8 to 1.8 molar. A study of a number of cell variables such as separator materials, blending techniques, and wetting agents is being made with inside-out type Mg/$MgBr_2$/m-DNB flat cells. Thus far organic flat cells have been made which give 68.5 watt-hr/lb at the 31 hr discharge rate. Half-cell potential and experimental dry cell data of nitrofuran, nitrothiophene, and other five membered heterocyclic nitro compounds are presented and their use as cathode materials in primary cells is considered. Performance data for Mg/$MgBr_2$/m-DNB cells in the Signal Corps Radio Set AN/PRC-35 are presented. (Author). (See also PB 150 581).

Radio Corp. of America, Somerville, N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen, R. A. Walck, and R. Glicksman. Quarterly rept. no. 5, 15 June-14 Sep 59, on Contract DA 36-039-sc-78048. [1959] 63p. 21 refs. AD-229 118.
Order from LC mi$3.90, ph$10.80 PB 150 583

This report released for sale to the public 12 Oct 60.

Work is being continued on the design of a practical flat type Mg/$MgBr_2$/m-DNB cell. At the present stage of their development these cells give 50 - 60 watt-hours/lb at discharge rates of 10 to 20 hours. Additional studies of the use of mercuric salt inhibitors in Mg/$MgBr_2$/m-DNB cells indicate performance gains of 15 - 20% at low current drains can be obtained with the use of HgS, HgSe, and HgTe additives. Data on the thermal and vacuum-thermal blending of m-DNB and carbon black indicate performance gains on high rate tests can be obtained with thermal treatments of Darco carbon black. Shelf-life data for A-size Mg/$MgBr_2$/m-DNB cells indicate a favorable six month shelf life for these cells. Impedance measurements of AA-size Mg/$MgBr_2$/m-DNB cells under a variety of conditions show these cells to have greater impedance than the Leclanche cells, especially at low frequencies and light current drains. A study of the electrochemical characteristics of organic hydrazine and hydroxylamine compounds is presented. The data indicate that hydrazine is a more attractive anode material than any of its organic derivatives. (Author) (See also PB 150 582)

Radio Corp. of America, Somerville, N. J.
PRIMARY CELLS UTILIZING ORGANIC COMPOUNDS AS THE ACTIVE COMPONENTS, by J. B. Eisen, R. A. Walck and others. Quarterly rept. no. 6, 15 Sep-15 Dec 59, on Contract DA 36-039-sc-78048. [1959] 67p. 13 refs. AD-234 156.
Order from LC mi$3.90, ph$10.80 PB 150 584

This report released for sale to the public 12 Oct 60.

Mg/$MgBr_2$/m-DNB flat cells on single cell tests simulating the BA-317 tests have given 12 hours service. The inner-anode and inner-cathode flat cell designs were found to give similar performance. The temperature coefficient for A-size Mg/$MgBr_2$/m-DNB cells was found to be 0.87 watt-hours/lb/°C. Shelf-life data for A-size Mg/$MgBr_2$/m-DNB cells continues to be favorable. Optimum performance for A-size Mg/$MgBr_2$/m-DNB cells using Columbia carbon was obtained from cells using a 3:1 m-DNB to carbon ratio. Experimental half-cell potential discharge data show the nitropyrimidine and nitrosopyrimidine derivatives to have a higher cathode potential than their benzene analogues. (Author) (See also PB 150 583)

Raytheon Co., Newton, Mass.
INVESTIGATION ON CERAMIC SEALS FOR ELECTRON TUBES, by Austin H. King. Final rept. for 9 Apr 59-31 Mar 60 on Contract AF 19(604)5706. 25 Apr 60, 39p. AFCRC-TR-60-151.
Order from LC mi$3.00, ph$6.30 PB 150 190

This report includes a review of the whole program to work out reliable methods for making seals for evaluation. Two types of seals are needed in vacuum tubes: a ductile braze for sub-assembly to accommodate some mismatch of expansion coefficients, and a reactive seal with suitably low vapor pressure and temperature for making the final seal in a vacuum. These requirements are met by a copper braze to a metallized ceramic and a reactive seal of Ni-Ti eutectic for the final seal. Details for making each type of seal are discussed. Figures of tensile strength are in doubt when derived from tests in compression or twisting, or from published values for the ceramics. Measurement of seal strength is here made by direct tensile tests. This method is applicable to the ceramics alone as well as to the seals. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
A PRECISION CONDUCTANCE BRIDGE OF NEW DESIGN, by George J. Janz and James D. E. McIntyre. Technical note no. 12 on Contract AF 49(638)50. June 60, 18p. 10 refs. AFOSR-TN-60-652; AD-240 365.
Order from LC mi$2.40, ph$3.30 PB 149 436

A conductance bridge in which the essential component is a precision impedance comparator and which combines speed, wide range, and high accuracy in measurements is described. While fundamentally similar in design and operation to the precision A. C. conductance bridges known today, the present design has the attractive features of simplicity of construction from unitized

components available on the market, and provision for use of the "four-leads" cell technique to eliminate connecting lead effects in remote conductance measurements. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
STEP TRANSFORMERS WITH LARGE TRANSFORMATION RATIO, by Edward Malowicki. July 60, 56p. 8 refs. RADC-TR-60-87.
Order from LC mi$3.60, ph$9.30 PB 150 268

This report is concerned with the problem of matching two real impedances whose ratio is large, for example, 36, over a wide band of frequencies, such as 65 to 285 megacycles, in the VHF band. The matching device considered, called a step transformer, is composed of cascaded lengths of transmission lines which may differ from each other in length and characteristic impedance. Results of investigation indicate that for a given maximum ripple, the Tchebyscheff transformer gives the best wideband performance with the least number of sections for the values of p and VSWR considered. (Author)

South Carolina U., Columbia.
CYLINDRICAL REFLECTORS FOR DIRECTING AND CONCENTRATING MICROWAVE BEAMS, by R. G. Fellers and F. E. Rouffy, Jr. Rept. on Contract AF 18(603)43. 1 Apr 60, 52p. 18 refs. AFOSR-TN-60-427; AD-237 565.
Order from LC mi$3.60, ph$9.30 PB 148 026

The straight-line transmission performance of a full-paraboloidal microwave antenna transmission system at 35.3 KMc was investigated theoretically and experimentally. To determine if the performance of this free space transmission system could be improved, four cylindrically shaped aluminum-foil-surfaced reflectors were designed, constructed, and placed midway in the transmission path so as to effect a 90^{o} "corner-reflection" of a transmitted beam, and in so doing to concentrate the beam in order to obtain a power gain over straight-line transmission. At the total transmission distances, D^2/λ, $2D^2/\lambda$, $4D^2/\lambda$ (36 ft., 72 ft., 144 ft.), transmission losses with a plane reflector were compared with the straight-line transmission losses; within meter accuracy (±0.2db.) these losses were measured as equal. Power gains resulting from the use of the cylindrically curved reflectors were then measured as gains over plane reflector transmission. Within the discrete range of transmission total distance, the minimum power gain was measured as 2.8 db. at D^2/λ. The maximum power gain was measured as 5.3 db. at $4D^2/\lambda$. Empirical rules were made for estimating the gain produced by the various curved reflectors. Design equations and considerations are presented for the construction of curved reflectors.

Stanford Electronics Labs., Stanford U., Calif.
AN IMPROVED ELECTROLYTIC TANK FOR DESIGNING ELECTRON GUNS, by A. S. Creason and M. D. Hare. Rept. on Contract DA 36-039-sc-73178. 25 Jan 60, 43p. 9 refs. Technical rept. no. 314-1.
Order from LC mi$3.30, ph$7.80 PB 147 912

This paper describes an improved electrolytic tank and circuit for rapidly and conveniently designing the focus electrodes of the Pierce type of electron gun for either solid or hollow beams. The tank has glass-epoxy-resin sides and a plate-glass bottom. It is rigid enough to be supported without distortion on three adjustable legs and light enough to be portable within the laboratory. The potentials from a maximum of twenty-four probes along the edge of the simulated electron beam are measured by a null method. To accommodate the two beam boundaries of a hollow-beam gun, signals from either of two sets of probes can be switched into the circuit. To avoid undesirable capacitance effects, the system uses a high-power, low-impedence signal source and a high-conductivity electrolyte.

Stanford Electronics Labs., Stanford U., Calif.
THE THEORY OF TWO PORTS, by J. G. Linvill. Rept. on Contract Nonr-225(44). 15 Oct 59, 29p. 4 refs. Technical rept. no. 1505-2.
Order from LC mi$2.70, ph$4.80 PB 149 491

The power gains, port immittances, and sensitivities of amplification to parameter variation are functions of the two-port parameters and terminating impedances. Expressions for these functions in terms of the common parameter types and the terminating immittances are necessary in amplifier design. It is simply shown that expressions for these functions in terms of general parameters can be written which are applicable for any particular parameter type. Two-port network theory is generalized here to treat the case of contaminating signals due to noise, temperature variation, or distortion. The form of the present discussion is definition of parameters which characterize the generation of contaminating signals in the two-port. In a subsequent step the transmission is considered of the contaminating signals from their point of origin to the output where they corrupt the desired signal being transmitted. In the final step one can select optimum terminating impedances which minimize corruption of the desired signal by the contaminating ones. (Author)

Stanford Electronics Labs., Stanford U., Calif.
TRANSHORIZON MEASUREMENT TECHNIQUES IN RADIO-WAVE PROPAGATION, by A. T. Waterman, Jr. Rept. on Contract DA 36-039-sc-73151. 15 Aug 58, 14p. Technical rept. no. 770-2.
Order from LC mi$2.40, ph$3.30 PB 149 405

In microwave transmission to distances well beyond the horizon, the received signal generally exhibits a characteristic fading. Measurements made on the received signal, in order to be considered representative, must be averaged over a time interval long compared with the period of the slowest fading component. Alternatively it is possible to perform certain kinds of measurements in a time interval short relative to the fastest fading components. Such a measurement yields an "instantaneous" picture of the effects produced by atmospheric conditions. A critical type of experiment involves the swinging of a narrow beam in order to resolve those signal components whose phase interrelationship determines the fading. This report discusses the information that can be obtained by using phased-array techniques in radio-wave propagation experiments.

Stanford Research Inst., Menlo Park, Calif.
RESEARCH IN MICROELECTRONICS USING ELECTRON-BEAM-ACTIVATED MACHINING TECHNIQUES, by Kenneth R. Shoulders. Interim scientific rept. on Contract Nonr-2887(00). Sep 60, 216p. 85 refs. SRI Proj. 2863.
Order from OTS $3.50 PB 171 027

Investigations into methods for obtaining electronic data processing systems of biological complexity indicate the feasibility of using over 10^{11} one-micron-sized active elements in a one-cubic-inch machine. An active element based upon the quantum mechanical tunneling of electrons from a metal into high vacuum is proposed that has an estimated switching time of 10^{-10} seconds; couples well to similar and accessory components; promises immunity to temperature variations; and seems adaptable to self-forming manufacturing methods giving component uniformity. Light detectors and generators and electrostatically operated electromechanical devices such as relays and filters seem to fulfill the requirements for accessory components so that all electronic functions could be accomplished with this microelectronic system; in addition, a micro document system would allow permanently stored data to be retrieved at a 10^{10} bit-per-second rate. A micromachining method for fabricating film materials is presented in which an electron beam is used to form a chemically resistant film on the material being machined, which is subsequently etched in vacuum by a molecular beam. This high-speed process has resolution capabilities of several hundred angstrom units; can process electronically clean materials with minimum contamination; and may ultimately be suited for the economical production of one-cubic-inch data processing systems having 10^{11} active components. (Author)

Stanford Research Inst., Menlo Park, Calif.
ROUNDED CORNERS IN MICROWAVE HIGH-POWER FILTERS AND COMPONENTS, by Seymour B. Cohn. Technical note no. 1 on Contract AF 30(602)1998. June 60, 41p. 13 refs. RADC-TN-60-148.
Order from LC mi$3.30, ph$7.80 PB 149 983

Various high-power filter configurations of importance are described, and the structural corners at which electric-field concentrations occur are pointed out. A number of simplified geometries are then shown that can represent the essential portions of the practical structures with sufficient accuracy for ordinary purposes. Formulas and graphs for these simplified geometries are presented that give the ratio of the maximum electric field strength on the boundary to a uniform reference field strength at a point sufficiently removed from the corner. In some cases the boundary shape is derived such that the electric field strength along the curve is constant. These constant-field-strength boundaries are optimum shapes from the standpoint of power-handling ability.

Stewart-Warner Electronics Corp., Chicago, Ill.
SYSTEM STUDY OF ATC INTERROGATION PATH SIDE-LOBE SUPPRESSION TECHNIQUES. Final rept. on Contract NOas-56-1013-d. [1959] 96p. 14 refs.
Order from LC mi$5.40, ph$15.30 PB 148 641

This is an engineering study and investigation leading to the development of an interrogation path side-lobe suppression system for use with the Common System Air Traffic Control Radar Beacon System. The three pulse system is proposed whereby the ground antenna is fed through a magic T connection so that the interrogation pattern is normal while the reference pattern which covers the side-lobe region has a notch in the forward direction. A system of pulse spacing for suppression is worked out so that suppression of transponders in the side-lobe region is accomplished with no modification to the airborne transponders now in use.

Technical Development Center, Federal Aviation Agency, Indianapolis, Ind.
THE NAVY ELECTRONICS LABORATORY PILLBOX ANTENNA AND ITS EFFECT UPON ATC RADAR BEACON INTERROGATION, by Joseph E. Herrmann, Jr. Owen E. McIntire, and Kenneth Wise. Aug 58, 22p. 2 refs. Technical development rept. no. 361.
Order from LC mi$2.70, ph$4.80 PB 147 942

The NEL Fox II pillbox antenna is an advancement in the state-of-the-art because the side lobes of the radiation pattern are of very low level. The evaluation program was concentrated on a determination of the effects that such an antenna would have on transponder interrogation. The results of the tests clearly indicate that very little improvement in system interrogation characteristics can be gained by use of an antenna having very low side lobes at installations where reflections are equal to, or greater than, those near TDC. Reflected main-lobe signals cancelled the interrogation duty-cycle improvements which were expected. It is felt that a significant improvement could be obtained at better sites. However, results of site surveys completed at some of the major airports indicate that little if any, improvement can be expected. (Author)

Technical Development Center [Federal Aviation Agency] Indianapolis, Ind.
A STUDY OF THE AIR TRAFFIC CONTROL RADAR BEACON SYSTEM CHARACTERISTICS, by Joseph E. Herrmann, Jr. Oct 57, 57p. 3 refs. Technical development rept. no. 329.
Order from LC mi$3.60, ph$9.30 PB 147 941

All data presented is based on the premise that this system must be compatible with the military beacon system and discussions are limited to those characteristics that can be changed without affecting the feature of compatibility. Nominal operating frequencies, trans mitted powers, pulse lengths, and pulse spacing are accepted as basic system requirements. (Author)

Technische Hochschule, Munich (West Germany).
WAVE PROPAGATION IN A PLASMA CABLE WITH AN IMPRESSED LONGITUDINAL MAGNETIC FIELD, by H. Riedel and J. Thelen. Technical final rept. for 1 Apr 59-31 Mar 60 on Contract AF 61(052)79. 1960, 84p. 13 refs; AD-241 298.
Order from LC mi$4.80, ph$13.80 PB 150 247

A comparison between theory and experiment brings the following final results: In contrary to theory the upper propagation limit of the forward wave is displaced by strong magnetic fields ($\Omega > \omega_0$) to values of

frequency greater than plasma frequency, nearly up to the gyro frequency. Apart from that at least a qualitatively good correlation with theory is obtained in both cases: forward wave and backward wave.

Willow Run Labs., U. of Michigan, Ann Arbor.
ELECTRON-NUCLEAR INTERACTION IN RUBY AND ITS EFFECT ON THE RUBY MASER, by George Makhov, Robert Terhune and others. Memo. on Project Michigan, Contract DA 36-039-sc-78801. July 60, 10p. 5 refs. 2900-175-R.
Order from LC mi$1.80, ph$1.80 PB 149 456

It has been found that changes in the polarization of the Al^{27} and Cr^{53} nuclei in ruby affect markedly the absorption or emission of microwave power associated with the electron-spin resonance of the Cr^{+++} ion. This effect has been used to observe weak nuclear resonances and to change markedly the operating characteristics of the maser. (Author)

Ordnance, Missiles, and Satellite Vehicles

Air Proving Ground Center, Eglin AFB, Fla.
A DISCUSSION OF TWO METHODS OF COMPUTING A FINDING EPHEMERIS FOR A CLOSE EARTH SATELLITE, by P. M. Fitzpatrick and G. B. Findley. May 60, 36p. 10 refs. APGC-TN-60-23; AD-237 628.
Order from LC mi$3.00, ph$6.30 PB 148 096

The instantaneous position of an artificial earth satellite is known when its altitude above the earth's surface and its geographical latitude and longitude are determined. Two procedures for computing a finding ephemeris are discussed: (1) use of the well-known relations of celestial mechanics to determine the geocentric equatorial rectangular coordinates, and (2) use of less familiar vectorial elements to derive similar results. Both methods should be useful for predicting satellite positions during a period of a few days following a satellite fix. The orbital elements are considered to be constant except for secular variations in the longitude of the node and the argument of the perigee arising from the oblateness of the earth. The two methods were used to compute sub-satellite latitudes and longitudes. Results of these computations are presented. (Author)

Air Proving Ground Center, Eglin AFB, Fla.
HYPERVELOCITY IMPACT FACILITY. LIGHT-GAS PROJECTOR. Mar 60, 24p. 4 refs. APGC-TN-60-22; AD-235 295.
Order from LC mi$2.70, ph$4.80 PB 147 817

A review of the Air Proving Ground Center's new hypervelocity projector and impact facility is presented pictorially. At present velocities of greater than 15,000 fps are obtainable at simulated altitudes up to 100,000 ft. Cameras operating at speeds from 1,200,000 to 2,400,000 frames per second record the impact data. Development of the facility is continuing. An improved projector which will provide higher velocities is being fabricated. Equipment to accurately record these high velocities and the impact results is currently in the testing stage. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
EVALUATION OF BALLOON CONDITIONER FOR ARTILLERY, by Ruth M. Welt. 15 Oct 59, 11p. 2 refs. USASRDL Technical rept. 2074; AD-228 447.
Order from LC mi$2.40, ph$3.30 PB 147 826

A simple, improved method of preconditioning meteorological balloons under field conditions is required for artillary use. Laboratory and flight tests were preformed which compared balloons preconditioned by the standard hot water method with balloons preconditioned by pressure cooker, steam generator, and heating mantle method. Results almost as good as with hot water were given by use of the heating mantle (dry heat) and it was recommended for field test by the Artillery Board. Maximum design performance of a particular balloon still requires the use of hot water for preconditioning. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
VARIABILITY OF BALLISTIC DENSITY AND BALLISTIC DENSITY DEPARTURE TABLES, by Marvin Lowenthal. 10 Nov 59, 12p. 5 refs. USASRDL Technical rept. 2079.
Order from LC mi$2.40, ph$3.30 PB 147 827

Based on a series of firings conducted at Fort Sill, Oklahoma, in April 1958, temporal and spatial variations of ballistic density were investigated for periods up to six hours and distances up to 500 miles. Comparisons of these data with the Ballistic Density Departure Tables permit a listing of the various sources of ballistic density in order of preference. It is concluded that the density departure tables should be used only as a backup system when other meteorological data are unavailable. (Author).

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ADVANCES IN THE DYNAMIC ANALYSIS OF RANGE DATA, by Charles H. Murphy. May 60, 40p. 12 refs. Memo. rept. no. 1270; AD-239 402.
Order from LC mi$3.00, ph$6.30 PB 149 091

The usual analysis of the dynamics of motion of a missile fired in a ballistic range is limited to symmetric missiles with constant mass. This analysis was extended by J. D. Nicolaides (AD-26 405) to cover the motion of a symmetric missile with misaligned lifting surfaces and a constant roll rate. Three additional extensions to the analysis of pitching and yawing motions are described: (1) motion of a burning rocket; (2) motion of a slightly asymmetric missile with varying roll rate; and (3) motion of missile with nonlinear aerodynamic moments. These extensions are each illustrated with actual experimental data. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BRL SHOCK TUBE TESTS OF AN AIR FORCE - PAN AMERICAN AIRWAYS SELF-RECORDING, PRESSURE-TIME GAGE, by Charles H. Hoover. June 60, 24p. 1 ref. Memo. rept. no. 1276; AD-240 397.
Order from LC mi$2.70, ph$4.80 PB 150 092

Pan-American Airways built self-recording mechanical pressure-time gages similar to gages employed extensively by the Ballistic Research Laboratories. The PAA gages are used to determine shock-wave overpressures from accidental explosions of missile and space vehicle propulsion units. A gage was sent to Aberdeen for dynamic testing in the BRL 24" Shock Tube. This report gives the results of this test and a comparison of the records from the PAA gage with those from an electronic standard gage. The Pan-American gage compares favorably with the standard gage and with results from the similar BRL gage. (Author)

Bureau of [Naval Weapons] Washington, D. C.
PERT SUMMARY REPORT, PHASE 2. Rept. on Project Pert. [1960] 239p.
Order from LC mi$10.20, ph$36.30 PB 150 672

This report released for sale to the public 12 Oct 60.

The project was directed to the research and development of improved methods for the planning and control of the complex and far-reaching program developing the Fleet Ballistic Missile (FBM). This phase of the project has been essentially the development of detail procedures and mechanics, the modification of concept as experience has proved advisable, and the "prove out" application of the method in several important areas of the FBM program.

Convair, San Diego, Calif.
EFFECTS OF SATELLITES ON THE IONOSPHERE, by S. Rand and R. A. Pappert. Rept. on Contract Nonr-2683(00). 1 Oct 59, 176p. 45 refs. ZPh-(024 - 026, 028, 038-M, 046, and 050-M); AD-233 351.
Order from LC mi$8.10, ph$27.30 PB 149 875

Contents:
Structure of the Satellite Wake, ZPh-028
Damping of the Satellite Wake, ZPh-040
Application of Bohm-Pines Theory to Plasma Motion, ZPh-026
Wake Structure for Highly Supersonic Flow, ZPh-038-M
Non-Linear Plasma Effect, ZPh-050-M
Magnetic Drag on Small Satellites, ZPh-024
Charge Excitation of Plasma Motion in a Magnetic Field, ZPh-025

Convair, San Diego, Calif.
[PHYSICS RESEARCH DIRECTED TOWARD THE ULTIMATE DEVELOPMENT OF A DEFENSE SYSTEM AGAINST BALLISTIC MISSILES]. Scientific rept. no. 3, 1 Dec 59-1 June 60, on Contract AF 19(604)5554, ARPA Order no. 116-60; Scientific rept. no. 2, 1 Dec 59-1 June 60, on Contract DA 04-495-ORD-1660, ARPA Order no. 39-59. 30 June 60, 342p. 95 refs. ZPh-062.
Order from LC mi$11.10, ph$53.10 PB 149 566

Physics research directed toward the ultimate development of a defense system against ballistic missiles. The work has been subdivided into three parts: (1) launch phase, (2) mid-course (with a further breakdown into experimental and theoretical) and (3) re-entry. Detailed discussions of the relationship between the various investigations and ballistic missile defense from the scientific standpoint are given at the beginning of each section.

Diamond Ordnance Fuze Labs., Washington, D. C.
A MISSILE-AIRCRAFT ENCOUNTER SIMULATOR WITH TYPICAL APPLICATIONS, by Richard F. Butler. 21 Dec 59, 41p. 12 refs. TR-757; AD-233 965.
Order from LC mi$3.30, ph$7.80 PB 147 794

The DOFL-developed encounter simulator is used as an aid in estimating fuzing and burst points for fixed-angle fuzed missiles used against various targets. With the methods developed herein, the simulator can be used to (1) evaluate the effectiveness of fuze-warhead systems against arbitrary targets by analyzing data from operational missile test flights and (2) estimate optimum fuze-warhead parameters needed for proposed systems to achieve the desired effectiveness. Three techniques are discussed for finding points of intersection of the light beam, that represents the fuze-antenna beam or the warhead lethal pattern, with a target model.

Diamond Ordnance Fuze Labs., Washington, D. C.
SUMMARY OF HEAT-POWDER CALORIMETRY, by Raymond H. Comyn and Ira R. Marcus. 1 Aug 60, 22p. 9 refs. Technical rept. TR-862.
Order from LC mi$2.70, ph$4.80 PB 149 421

This report summarizes DOFL investigations in the calorimetry of gasless pyrotechnic mixtures which have been published previously in separate reports. These papers outline the development of two instruments: the DOFL quality control calorimeter for production use; and the DOFL microcalorimeter for research studies. The production calorimeter may be used for measuring heat inputs between 800 and 1200 cal with a precision of ±0.32 percent. The microcalorimeter has an accuracy of about 1 percent and may be used for measuring heat inputs of 100 to 300 cal at ambient temperatures between -65°F and +165°F. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
INFLUENCE OF SILVER COATINGS ON IGNITION BEHAVIOR OF COLLOIDAL LEAD AZIDE, by Bruno Reitzner. Aug 60, 14p. 5 refs. Technical rept. FRL TR-2.
Order from LC mi$2.40, ph$3.30 PB 148 915

Colloidal α-lead azide was coated with small amounts of silver (0.25 - 10.0 atom %). The coatings were applied by reducing silver nitrate with hydrazine hydrate in a methanol-water solution in which lead azide was suspended. The metallic silver was found to be predominantly located near the edges of smaller or irregularly shaped lead azide crystals. Ignition tests run between 351°C and 411°C gave ignition times ranging from infinity to 0.035 second. Coating the material with 1 atom % of silver reduced its ignition times by as much as 60%. However, the ignition times of material coated with 10 atom % of silver were up to 1.5 times as high as those of the uncoated material.

The apparent activation energies, E*, were calculated from the Semenov equation at temperatures ranging from 377° to 389°C. Deviations from the Semenov equation were found at both higher and lower temperatures. E* for the uncoated lead azide was found to be 132 ± 10 kcal/mole. Values of 120 ± 10 kcal/mole and 138 ± 5 kcal/mole were found for materials coated with 1 atom % and 10 atom % of silver, respectively. The increase in thermal sensitivity of the material coated with about 1 atom % silver is explained as due to the catalytic action of the silver. (Author)

Frankford Arsenal, Philadelphia, Pa.
RATE OF FIRE IN RECOILLESS RIFLES, by R. Boritz. Sep 59, 26p. 6 refs. Memo. rept. M60-3-1.
Order from LC mi$2.70, ph$4.80 PB 148 661

A method for the calculation of rate of fire for recoilless weapons is described. Rate of fire limitations in recoilless rifles are a result of degradation of material strength with increase of temperature. Based on this, it is possible to calculate maximum permissible sustained rates of fire. The calculation of average system temperatures after firing a specified number of rounds, at specified times, with specified external conditions, is presented for several different assumptions. Cooling methods are discussed and sample calculations are presented.

Frankford Arsenal, Philadelphia, Pa.
ULTRASONIC INSPECTION OF EXPERIMENTAL ALUMINUM ARMOR PLATE, by Helen Smolen. 26 Aug 59, 24p. 5 refs. Test rept. T60-1-1; AD 229 500.
Order from LC mi$2.70, ph$4.80 PB 150 305

Ultrasonic tests were performed to locate areas yielding gradients of ultrasonic response in experimental aluminum armor plate. Representative areas were subjected to tensile impact and metallographic tests. Because it is difficult to determine precisely which portion of a given volume may introduce the ultrasonic gradients observed, no conclusion could be drawn as to the ability of ultrasonics to detect structural deviations other than comparatively gross discrete flaws. Armor plate, portions of which had been subjected to ballistic test, were examined to determine the relationship between ballistic test results and ultrasonic response. The average percentage of noise level, which was characteristic of each plate, did not correlate with ballistic test results, in that a ballistically good plate appeared to be as likely to yield a high average noise level as a ballistically bad plate. No edge cracks were located in the many plates examined during the course of this program. However, results obtained under an earlier study indicate that this type of flaw is easily detected ultrasonically, as are other comparatively gross flaws. Standard immersion techniques introduced problems which may be overcome by use of a modified immersion technique which is described. (Author).

General Electric Co., Schenectady, N. Y.
DISPERSION OF THE HERMES A3 MISSILE: RANGE ERRORS DUE TO VARIATION IN POSITION AND VELOCITY AT THE END OF CONTROL, by R. F. Drenick. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. 30 Aug 48, declassified 17 Nov 58, 34p. 2 refs. Rept. no. 55263.
Order from LC mi$3.00, ph$6.30 PB 149 466

The Hermes A3 missile is a surface-to-surface missile, subject to very stringent requirements concerning the accuracy of hitting. These requirements suggested a study of all factors which might, in the absence of proper control, produce impact errors, and of possible means of reducing these errors. An account is given in this report of the range errors which would result if the missile position or velocity have deviated from the desired standard at the time at which guidance is discontinued. The conclusion is reached that control principles similar to those of the German V-2 in which control ceases at some time before impact, are not likely to insure the specified accuracy. The methods of differential corrections are generalized in this report from the form which they take in conventional ballistics to that form which would apply to guided missile ballistics. (Author)

General Electric Co., Schenectady, N. Y.
GROUND VIBRATION TESTS OF THE HERMES A1 TEST VEHICLE, by E. A. Zeitlin. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. 27 Apr 49, 47p. 5 refs. Rept. no. 55276.
Order from LC mi$3.30, ph$7.80 PB 149 469

The object of the vibration tests was to determine the natural frequencies, the vibration characteristics, and the location of the nodal lines for the significant modes of vibration of the main airframe components of the Hermes A1 test vehicle. The information has been used in (a) flutter analyses, (b) calculations of torsional divergence, (c) study of possible coupling between oscillations of the main airframe components, (d) investigation of possible coupling action between control, guidance, and structural components of the missile viewed as an elastic body.

[General Electric Co., Schenectady, N. Y.]
HERMES A-1. A. MOTORS. B. PROPULSION. C. CONTROL. D. AERODYNAMICS. E. GUIDANCE. F. SCHEDULE. Rept. on [Contract DA 30-115-ORD-23]. [1949] declassified 28 May 58, 14p. Proj. Hermes A-1 Motors rept. 62.
Order from LC mi$2.40, ph$3.30 PB 149 463

General Electric Co., Schenectady, N. Y.
THE HERMES A-3 FLIGHT SIMULATOR, by N. M. Bengston. Rept. on Project Hermes [Contract DA 30-115-ORD-23]. July 49, declassified 17 Mar 58, 22p. Technical Information Series R49A0525.
Order from LC mi$2.70, ph$4.80 PB 149 471

The 50,000:1 variation in dynamic pressure imposed by the Hermes A-3 trajectory creates particular problems in design of autopilot and means for testing it. An electrical integrator type of analogue computer has been designed to simulate the missile equations. Actual components complete the remainder of the flight simulation loops. (Author)

General Electric Co., Schenectady, N. Y.
UPWASH FIELD INDUCED BY THE HERMES B-1 WING AT SEVERAL MACH NUMBERS, by H. R. Koenig. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23]. Dec 50, declassified 17 Mar 58. 16p. 4 refs. Technical Information Series rept. no. R50A0525.
Order from LC mi$2.40, ph$3.30 PB 149 205

The upwash field induced by the B-1 wing is presented for several Mach numbers. Since the purpose of this study was to determine the effect of upwash on the tail fin performance, the upwash field is plotted in the plane perpendicular to the free stream direction and passing through the leading edge of the tail fins. (Author)

General Electric Co., Syracuse, N. Y.
S-BAND ATTENUATION IN THE OXYGEN-ALCOHOL ROCKET MOTOR, by R. H. Morrison. Rept. on Proj. Hermes, Contract [DA 30-115-ORD-23] June 50, declassified 17 Mar 58. 46p. 8 refs. Technical Information Series rept. no. R49A0535.
Order from LC mi$3.30, ph$7.80 PB 149 203

The attenuation of an S-band beam through the flame of a 16,000-pound thrust oxygen-alcohol motor (Hermes A-1 missile) was measured. No average attenuation was measured; there were transient attenuations of the order of 20 db at the start and shut down and random transient attenuations of 5-10 db during smooth burning period. Some noise attenuation showed on the records. (Author)

Hughes Aircraft Co., Culver City, Calif.
DISPLAY AND CONTROL REQUIREMENTS FOR MANNED SPACE FLIGHT, by Charles O. Hopkins, Donald K. Bauerschmidt, and M. J. Anderson. Rept. on Human Performance in Advanced Systems, Contract AF 33(616)6033. Apr 60, 217p. 175 refs. WADD Technical rept. 60-197.
Order from OTS $3.50 PB 161 987

A study was made of the display and control requirements for a manned orbital vehicle of the "space-ferry" type. The mission included ground launch, rendezvous with a satellite station already in orbit, re-entry into the earth's atmosphere, and landing at a selected base on earth. Display and control requirements were determined for vehicle attitude control while in orbit, orbital plane change, minimum energy transfer between circular orbits at different altitudes, and deorbit for re-entry into the earth's atmosphere. Displays, controls, and control panels were designed to meet these requirements. Representations of these displays and controls were constructed and incorporated into full-scale mockups of cockpits for two alternate display and control systems. (Author)

Institute of Metals and Explosives Research, U. of Utah, Salt Lake City.
FRAMING CAMERA OBSERVATIONS OF ULTRA-HIGH VELOCITY PENETRATION IN TRANSPARENT TARGETS AND A MECHANISM FOR CRATER EXPANSION, by R. W. Bartlett and R. T. Keyes. Rept. on Contract AF 18(603)100. 31 Mar 60, 21p. 5 refs. AFOSR-TN-60-851.
Order from LC mi$2.70, ph$4.80 PB 150 167

A mechanism of cratering in metal targets impacted by shaped charge jets in which the hole diameter is expressed as a function of striking velocity jet diameter, densitites of target and jet, and the yield strength of the target is presented and compared with measured hole diameters in several different metals struck by iron, copper and aluminum jets at various velocities. The same mechanism is expanded to account for the dynamics of crater formation, i.e., the lateral rate of expansion of the crater. Theoretical curves are compared with experimental results obtained by means of microsecond framing camera techniques for steel jets penetrating several transparent substances of different densities. Some additional results pertaining to vaporization in ultra-high velocity impact also are given. (Author)

Naval Ordnance Lab., Corona, Calif.
PRIMARY FACTORS THAT AFFECT THE DESIGN OF GUIDED MISSILE FUZING SYSTEMS, by K. A. Van Orsdel. 8 July 60, 16p. NAVWEPS rept. 5953; NOLC rept. 452.
Order from LC mi$2.40, ph$3.30 PB 149 794

The primary factors that must be taken into consideration preparatory to designing any guided missile fuzing system or fuze component are listed in outline form. Main categories of factors affecting missile fuze design are: Weapon System General Requirements, Tactical Conditions, Target Characteristics, Missile Characteristics, Warhead Characteristics, and Weapon System Logistics and Field Operation. Several factors are listed under each category. (Author)

Naval Ordnance Test Station, China Lake, Calif.
COMPOSITE PROPELLANT PROCESSING. PLASTIC MANDREL FABRICATION. 1 July 59, 15p. NOTS TP 2307.
Order from LC mi$2.40, ph$3.30 PB 150 290

Strong, lightweight plastic mandrels can be fabricated from aluminum-filled epoxy resins very economically and in a very short time. These plastic mandrels are accurate reproductions of aluminum or wooden mandrels.

Naval Ordnance Test Station, China Lake, Calif.
INTERVAL TIMER MARK 5 MOD 1; LATIN-SEQUENCE ENVIRONMENT TEST FOR QUALITY ASSURANCE AND IMPROVEMENT, by K. G. Clemans and R. E. Crescenti. 6 May 59. NOTS TP 2254; NAVORD rept. 6554.
Order from LC mi$3.90, ph$10.80 PB 149 530

This report presents a logical, inexpensive, yet comprehensive, method of qualification testing with application to the Mk 5 Mod 1 Interval Timer. Qualification testing of this type has general application in development as well as procurement programs where the test conditions imposed are presumed nondestructive. (Author)

Naval Weapons Lab., Dahlgren, Va.
EVALUATION OF BLOW-OUT PIPE SYSTEMS FOR USE ON TERRIER MISSILE SHIPS, by A. C. Samuels. 11 Aug 60, 49p. 1 ref. NWL rept. no. 1714.
Order from LC mi$3.30, ph$7.80 PB 150 276

The Naval Weapons Laboratory has conducted two blow-out pipe tests to determine the structural adequacy of the closed blow-out pipe system installed in check-out areas of DLG-9 class TERRIER missile ships and to determine the feasibility of replacing the portable section of blow-out pipe by an inlet funnel installed on the bulkhead in check-out areas on proposed DLG-16 and DLG(N)-25 class TERRIER missile ships. These tests were conducted during the period from 5 May 1960 to 13 May 1960 using TERRIER BT-3 sustainers. The results of the two tests indicate that the closed system as used on the DLG-9 class ships is more effective than the proposed DLG-16 open system in removing the exhaust gases from a burning sustainer. As a result the closed system reduces the hazards to personnel, and is to be preferred. (Author)

North Carolina State Coll., Raleigh.
ON THE THEORY OF MOTION OF A NEAR EARTH SATELLITE, by Raimond A. Struble and William F. Campbell. Technical memo. no. 4 on Contract DA 36-034-ORD-2733. June 60, 5p. 7 refs. OOR rept. no. 2125.9-M; AD-238 904.
Order from LC mi$1.80, ph$1.80 PB 150 400

First and second order solutions of the equations of motion of a near earth satellite were obtained. These solutions are completely general without restrictions on eccentricity or orbital inclination. Though the traditional orbital plane of astronomy is employed, a non-elliptical orbit in this plane displays the basic geometry more readily than would the traditional osculating ellipse. (Author).

Office of Defense Research and Engineering, Washington, D. C.
SHOCK, VIBRATION AND ASSOCIATED ENVIRONMENTS. PART IV. June 59, 143p. 20 refs. Bulletin no. 27; AD-212 977.
Order from LC mi$7.20, ph$22.80 PB 150 286

This report released for sale to the public 26 Sep 60.

Design and use of vibration test jigs and fixtures: Nature of the vibration testing problem; Design criteria for vibration test jigs and fixtures; Scope of the vibration fixture problem; Vibration fixtures for large test items; Multi-purpose environmental test fixtures; A critical look at vibration fixture performance; Investigation of vibration fixture materials; Comments on seminar on jigs and fixtures; Experimental and theoretical study of an oil film slider; Improved version of the fluid film method of stabilizing an auxiliary vibration table; Oil-film supported table for vibrating large components; Building an inertial guidance facility. Correlation of the effects of laboratory vs service environments on hardware: Real and simulated environment; A specification writer's viewpoint; Damage accumulation in relation to environmental testing; Method of equating long duration-low intensity and short duration-high intensity random vibration; Evaluating the effects of logistic environments on missile reliability; Reliability and mechanical design. Information exchange: National Bureau of Standards calibration service for vibration pickups; Ad Hoc Committee on transportation hazards; Research program on random vibration.

Picatinny [Research Center] Picatinny Arsenal, Dover, N. J.
DEVELOPMENT OF DELAY POWDERS, by Burton Werbel and Seymour Lopatin. Apr 58, 37p. 2 refs. Technical rept. 2477; AD-159 055.
Order from LC mi$3.00, ph$6.30 PB 148 991

The effects of the following factors on the burning characteristics of the barium chromate/boron system have been investigated: (a) chemical composition; (b) vapors; (c) external pressure; and (d) temperature.

[Picatinny Research Center] Picatinny Arsenal, Dover, N. J.
THE ROLE OF PARAFORMALDEHYDE IN THE PREPARATION OF HMX BY THE PICATINNY PROCESS, by Thomas C. Castorina, Frederick S. Holahan and others. Feb 58, 40p. 25 refs. Technical rept. 2481; AD-157 692.
Order from LC mi$3.00, ph$6.30 PB 148 992

To find means of further improving the yield of HMX from the Picatinny Arsenal (PA) nitrolysis of hexamine, the role of paraformaldehyde in the reaction was traced with carbon-14. These results demonstrate that both HMX and RDX molecules are derived from chemically equivalent carbon atoms or methylene groups. Thus the role of the $(CH_2O)_x$ is postulated as increasing the concentration of methylene groups in the percursors of HMX/RDX thereby making more efficient use of the nitrogen in the hexamine possible.

Pitman-Dunn Labs. Group, Frankford Arsenal, Philadelphia, Pa.
FLUID DYNAMIC MODEL OF INTERIOR BALLISTICS, by S. Jarvis, Jr. Feb 60, 55p. 4 refs. Memo. rept. M60-24-1.
Order from LC mi$3.60, ph$9.30 PB 149 055

Equations are derived for the transient one-dimensional motion of a propellant gas-propellant grain mixture capable of giving, qualitatively, the effect on the interior ballistic process of factors not included in space-mean models. These general equations and certain one-parameter reductions are discussed, and the computing difficulties assessed. A few extreme simplifications, which allow analysis of certain representative features, are made and the results given. (Author)

Remington Arms Co., Inc., Bridgeport, Conn.
DEVELOPMENT AND FABRICATION OF PERCUSSION PRIMER FOR BAG LOADED WEAPONS, by R. A. Sahlin. Monthly progress rept. no. 2, 31 May-30 June 60, on Contract DA 19-020-ORD-5200. 14 July 60. 6p.
Order from LC mi$1.80, ph$1.80 PB 149 831

Approximately one hundred XM-82 primers were made. Product performance tests were conducted with satisfactory performance indicated. Work on the Remington alternate has continued with inner cases processed through drawing and heading. A considerable amount of experimental work of the outer case has been done and is continuing in an attempt to achieve drawing dimensions. (See also PB 149 325)

Rock Island Arsenal Lab., Ill.
DENSITY VERSUS VISCOSITY AS IT INFLUENCES THE ACTION OF A RECOIL MECHANISM, by H. C. Muffley. 11 Mar 60, 27p. 10 refs. Rept. no. 60-598; AD-234 720.
Order from LC mi$2.70, ph$4.80 PB 147 340

The influence of density and viscosity of the hydraulic oil on the functioning of a hydropneumatic recoil mechanism was investigated under firing conditions with a 105 MM Howitzer Recoil Mechanism and three oils varying in density and viscosity. The data indicated that changes in density had a significant effect on the operation of the mechanism. Increasing the density of the oil manifested itself in shorter recoil length and increased pressures. Variations in viscosity, however, did not influence the functioning of the mechanism significantly. (Author)

Solid Propellant Information Agency, Johns Hopkins U., Silver Spring, Md.
JOINT ARMY-NAVY-AIR FORCE IGNITABILITY PANEL. PROCEEDINGS OF THE THIRD MEETING HELD AT APPLIED PHYSICS LABORATORY, SILVER SPRING, MARYLAND, JUNE 19, 1959. Rept. on Contract NOrd 7386. [1959] 81p. 12 refs.
Order from LC mi$4.80, ph$13.80 PB 150 779

This report released for sale to the public 14 Oct 60.

The purpose of the Ad Hoc Panel on Ignitability is to review the existing procedures and equipment for measuring the ignitability of solid propellants and to standardize on one of these techniques if at all possible. The primary purpose of the third meeting was to review the results obtained from a round-robin ignitability testing of four standard propellants and to utilize conclusion drawn from this review to formulate recommendations for a standard ignitability apparatus. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
A METHOD FOR CALCULATING THE THERMAL IRRADIANCE UPON A SPACE VEHICLE AND DETERMINING ITS TEMPERATURE, by Thomas L. Altshuler. Rept. on Contract AF 04(647)269. Aug 60, 59p. 15 refs. Technical Information Series R60SD386.
Order from LC mi$3.60, ph$9.30 PB 149 846

A method is presented for determining the thermal irradiance upon a space vehicle due to direct solar radiation, planetary thermal radiation, and planetary albedo. From this information the temperature of a space vehicle can be obtained. Calculations can be made for various space vehicle altitudes above a planet and for various solar angles with respect to both the planet and space vehicle. The planets and natural satellites considered are the Earth, Moon, Mars and Venus. (Author)

Springfield Armory, Mass.
DEVELOPMENT OF THE PERMETRON GAGE FOR THE MEASUREMENT OF 20MM BARREL BORE PLATING THICKNESS, by H. P. Hatch and C. N. Julian. Rept. on Engineering of Application of Non-destructive or Simulated Testing Methods and Equipment to Small Arms Weapon Items. 3 Apr 60, 19p. SA-TR20-6003; AD-238 004.
Order from LC mi$2.40, ph$3.30 PB 150 017

The Permetron operates on the principle that the coupling between two windings linked by a magnetic circuit varies with the permeability of the magnetic circuit. The magnetic circuit consists of the core carrying the two windings, the barrel steel, and the interposed chromium. If the magnetic characteristics of the barrel steel and core are held constant, then the magnetic circuit variable affecting permeability will be the thickness of chromium. In this instrument, coupling is indicated in terms of a secondary output voltage with controlled primary input current. This output voltage varies directly with the permeability of the magnetic circuit and therefore is a function of the thickness of the chromium plate. A low frequency, 60 cps, is employed to reduce eddy currents, and to minimize the effect of variation in the magnetic properties of both the barrel steel and the deposited chromium. The maximum error in thickness measurement is 0.33×10^{-3} inches. (Author)

Stanford Research Inst., Menlo Park, Calif.
VOLTAGE BREAKDOWN OF ANTENNAS AT HIGH ALTITUDES, by W. E. Scharfman and T. Morita. Technical rept. 69 on Contract AF 19(604)3458. Apr 60, 100p. 16 refs. AFCRC-TN-60-750
Order from LC mi$5.40, ph$15.30 PB 149 897

The signal received from electronic systems on various missiles has contained evidence of voltage breakdown on antennas at altitudes from 50,000 to 300,000 feet at VHF, UHF, and microwave frequencies. Since continuous telemetry and tracking information is often necessary to determine impact position and system performance, an experimental investigation has been made of the power-handling capabilities of antennas at high altitude. The principal aims of the study are (1) to determine the physical mechanisms involved, (2) to measure and tabulate experimental data on breakdown field strength for various antenna types, and (3) to study methods for improving the power-handling capabilities of antennas.

Watervliet Arsenal, N. Y.
FIRING TESTS ON T42E1 AND T32E1 IGNITERS IN THE 105MM T254E2 TANK GUN, by F. J. Dashnaw and K. C. Stotz. Feb 60, 26p. Technical rept. WVTRR-6002.
Order from LC mi$2.70, ph$4.80 PB 145 817

A number of igniters were test fired in a 105MM, T254E2 gun tube and breech ring assembly in addition to insulation tests. It was determined that the gun would perform satisfactorily, from an electric firing standpoint, using either a capacitive discharge power source or a 24 volt battery, under normal room conditions. The direct battery power source is recommended because of lower space requirements and fewer possible difficulties. (Author)

Watervliet Arsenal, N. Y.
AN OPTICAL METHOD FOR MEASURING STRAIGHTNESS OF GUN TUBE BORES, by D. Bisceglia and P. M. Casey. Dec 59, 27p. Technical rept. WVT RI 5906.
Order from LC mi$2.70, ph$4.80 PB 146 478

This project was initiated to provide a telltale system which would be more accurate and require less skill of the operator. Using optical principles, bore inspection can be accomplished in a reasonable time by using a machine in which the tube can be indicated to a common center line of machine spindle and instrument optical axis. This system is the most precise technique available for process and acceptance inspection of finished and semi-finished bores. However, the use of this technique for determining the axis of rough cored holes is not recommended for medium size cannon since the benefits derived do not offset the increased time required to perform this operation. The equipment developed is applicable to machine alignment and the telltale record sheet designed is applicable to either optical or mechanical telltale readings. (Author)

Watervliet Arsenal, N. Y.
TRANSIENT THERMAL STRESSES IN GUN TUBES, PART I, by C. C. Mow, M. J. Pascual, and J. J. Pascual. Mar 60, 104p. 8 refs. Technical rept. WVT RR-6003.
Order from OTS $2.50 PB 161 475

The study was made to determine the temperature field and thermal stress distribution in a gun tube (hollow cylinder) assumed for simplicity to be infinitely long. The boundary conditions considered were independent of axial distance, and dependent only upon time. Various functions of time were considered in fixing the temperature at the inner wall. The choice of these functions was determined by the data obtained in the actual firing of a gun. All quantities are in dimensionless form. The dimensionless temperature fields were determined in a closed form, while the thermal stresses were left in an integral form and solved by numerical integration using an IBM 650 digital computer.

Numerical results were obtained for various parameters which cover most of those of interest to the Ordnance Corps. (Author).

Sanitation and Safety Engineering

Arctic Aeromedical Lab., Ladd AFB, Alaska.
PRELIMINARY STUDIES ON ELECTRIC INCINERATOR TOILETS FOR USE UNDER REMOTE ARCTIC CONDITIONS, by Jack D. Douglas. May 60, 12p. Technical note AAL-TN-60-7.
Order from LC mi$2.40, ph$3.30 PB 150 027

It is felt that electric incineration would be an effective and satisfactory means of human waste disposal at remote arctic sites. An electric incinerator toilet, which had originally been developed for use aboard aircraft, was modified and field tested for possible ground use. Numerous difficulties inherent in the unit manifested themselves during the period of the tests. However, results of the tests did indicate that electric incineration would be a feasible means of human waste disposal. Recommendations were made for the construction of an electric incinerator toilet designed for ground use. (Author)

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DECONTAMINATION OF WATER CONTAMINATED WITH PLUTONIUM, by Maurice Pressman and Don C. Lindsten. Rept. for 24 Feb-3 Apr 59 on Removal of CBR Contaminants from Water. 12 Jan 60, 91p. 26 refs Research rept. 1613-RR; AD-234 603.
Order from LC mi$5.40, ph$15.30 PB 147 816

The report concludes that: (a) The Army Mobile Water Purification Unit is capable of removing essentially all particulate plutonium from water by the standard processes of coagulation with ferric chloride and limestone disinfection, and diatomite filtration; (b) the Army Mobile Water Purification Unit is capable of removing 72% of the plutonium from contaminated tap water in which most of the plutonium is in soluble form. The percentage is increased to 89 by the addition of 600 ppm activated carbon and 97.5 percent by the addition of 100 ppm activated carbon and 97.5 percent by the addition of 100 ppm of clay to clear raw water and by raising pH to 11.4; (c) mixed-bed ion-exchange resin and high-capacity cation-exchange resin on the hydrogen cycle are both capable of removing over 99% soluble plutonium from contaminated water; (d) a proposed Army squad method of removing CBR agents from water is capable of removing over 99.9 percent plutonium activity even when in the soluble form; (e) cation-exchange water-softening unit is ineffective; (f) alum coagulation and sand filtration is 95% effective; (g) activated carbon in high dosage is an effective adsorbent; and (h) lime-soda softening is 97% effective. (Author)

Communicable Disease Center [Atlanta] Ga.
COMPOSTING OF ORGANIC WASTES. AN ANNOTATED BIBLIOGRAPHY, Supplement 2, ed. by John S. Wiley. Apr 60, 65p. 102 refs.
Order from LC mi$3.90, ph$10.80 PB 148 097

This bibliography includes author, geographical and subject indexes. (See also PB 147 220)

Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPARTMENT-TYPE AIR LOCK STUDIES, by Ernest N. Hellberg. Final rept. 28 June 60, 38p. 8 refs. Technical rept. 036.
Order from LC mi$3.00, ph$6.30 PB 149 230

A portable, prefabricated, interior air lock has been developed and compared against the BUDOCKS standard, exterior one. Extensive tests under various building-pressures, air flows, and environments revealed that both locks operated satisfactorily when air flow exceeded 300 cfm; that the NCEL lock had inadequate air-flow regulation; and that the BUDOCKS lock was unwieldy. NCEL redesigned its air lock to incorporate the best features of both the BUDOCKS and the NCEL prototype, and to eliminate their shortcomings. Considering the final NCEL lock suitable for interior use is recommended. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
SPECIFICATIONS AND COSTS OF A STANDARDIZED SERIES OF FALLOUT SHELTERS, by W. E. Strope, L. G. Porteous, and A. L. Greig. 6 Oct 59, 153p. 29 refs. Research and development technical rept. USNRDL-TR-366.
Order from OTS $3.00 PB 161 973

Basic performance specifications are developed to govern the design of personnel shelters to provide protection against radioactive fallout. Consideration is also given to protection against blast, heat, and fires. Design specifications and cost estimates are prepared for a shelter based on a 25 ft by 48 ft ammunition storage magazine. Provision is made for 14-day occupancy by 100 people. The cost differentials of various choices of performance characteristics are estimated. The design is in sufficient detail to permit construction. Shelters of this type may have wide application in residential areas, industrial plants, and military installations. (Author)

Northwestern Technological Inst., Evanston, Ill.
THE DYADIC COMPUTATION OF A GENERALIZED NETWORK MODEL OF A SEWAGE TREATMENT SYSTEM, by W. R. Lynn (U. of Miami) and A. Charnes. ONR Research Memo no. 19 on Temporal Planning and Management Decisions under Risk and Uncertainty [and] Systems Analysis of Municipal Sewage Treatment, Contract Nonr-1228(10). Oct 59, 23p. 5 refs. AD-230 198.
Order from LC mi$2.70, ph$4.80 PB 149 500

A computational method is presented and demonstrated for the analysis of a problem involved in the determination of the most economical sewage treatment system by which certain impressed effluent standards of quality can be attained. A sewage treatment system was considered as a combination of unit operations which may be employed in series or parallel. Each of the unit operations has the capacity for effecting some change (e.g., a reduction) in the quantity of the waste which utilizes the operation. The cost of each operation per unit of sewage treated varies from operation to operation as does the effect of each operation on the quality of the waste. (Author)

Ship Building

Bureau of Ships, Washington, D. C.
SHOP PRACTICE SUGGESTIONS NO. 2. Nov 60, 24p.
Order from OTS $0.50 PB 171 024

The suggestions included are for fitting brushes; multiple gasket cutter; compressor linear extractor; segmented anode pencils; coaming around fuel tanks; gas test holes; stuffing tube area templates; reworked stellite bushings; plate-stretching bars; ammeter records shaft trepanning; blueprint machine roller cover; gas holes in doubler plates; welding electrode holder; hole cutter for aluminum plate; undercut gage; adjusting SPS-8 potentiometer; toggle switch guard; deck drain sleeves; photographs of electronic wiring; boat gripes; lifeboat equipment air-freed; ventilation spools; SASS bridge crane; repairing uptakes; LST bow ramp gaskets; casting tin-bronze manifolds; purge plug for pipe; microswitch checker; valve seat grinder; soldering tips modified; jet cable reel rims; metal photo process; metallic splice gear; cold storage space; jet blast deflector alignment; bomb elevator hatch; crane radiator petcock; pipes through aluminum; penetration reinforcements; hydraulic control valves; torpedo tube gage; steam catapult cylinders; surplus STS plating; roller grip couplings; battery cell handling case; battery cell test plug; cable marking; catapult winch frame racks; cutting torch tips reconditioned; bilge keel installation; sea chest blank; globe stop-lift-check valve; brake applicator valve; steam catapult jack; fuel status chart. (See also PB 161 715)

David Taylor Model Basin, Washington, D. C.
STRUCTURAL EVALUATION OF HYDROFOILS OF GIBBS AND COX BOAT SEA LEGS, by Louis A. Becker. July 60, 24p. 5 refs. Rept. no. 1401.
Order from LC mi$2.70, ph$4.80 PB 152 019

This report released for sale to the public 11 Oct 60.

Strains were measured in the hydrofoils and struts of the Gibbs & Cox boat SEA LEGS for known static loads, for operation in calm water under steady-state conditions and forced maneuvers, and for operation in 5-ft waves. Underway loads and load factors were determined. Experimental and theoretical stresses were compared. Motions and accelerations of the boat were also measured during the underway trials. It is concluded that the hydrofoil system is adequate to withstand the stresses resulting from operation in waves up to 5 ft in height at speeds up to 23 knots. (Author)

David Taylor Model Basin, Washington, D. C.
TMB 3-BLADED SUPERCAVITATING PROPELLER SERIES, by E. B. Caster. Aug 59, 29p. 5 refs. Rept. 1245.
Order from LC mi$2.70, ph$4.80 PB 150 676

This report released for sale to the public 11 Oct 60.

A theoretical series of 3-bladed supercavitating propellers, having a hub radius of 0.2 of the propeller radius and an expanded area ratio of 0.5, is presented. The design parameters for these propellers are plotted in the form of nondimensional coefficients which enable a complete design to be obtained. (Author)

Hamburg U. (Germany).
ROLL RESONANCE IN A TRANSVERSE SWELL, by Hellmut H. E. Baumann. Technical rept. on Contract no. 62558-1544/2237. May 59, 100p. 14 refs.
Order from LC mi$5.40, ph$15.30 PB 150 011

The roll oscillations of a ship in a seaway are generated by both horizontal and vertical accelerations. The two types of stationary roll states due to these different components are considered for the general case of nonlinear restoring moments and damping. With a suitable assumption for the exciting function (wave profile), analytical expressions are devised for the dependence of the amplitude and periods of the roll oscillation on

those of the swell. The response curves and the stability limit of the forced oscillations can be evaluated if the phase integral and period of the undamped oscillation in calm water are known. (Approximate methods of evaluating these as functions of the roll amplitude are given). The method is illustrated for two different cases of righting arm curves. (Author)

FOOD, HANDLING, AND PACKAGING EQUIPMENT

Air Research and Development Command, Washington, D. C.
FOOD FOR SPACE TRAVEL: AN EXAMINATION OF CURRENT CAPABILITIES AND FUTURE NEEDS, by Albert A. Taylor, Beatrice Finkelstein and Robert E. Hayes. July 60, 71p. 67 refs. ARDC-TR-60-8.
Order from LC mi$4.50, ph$12.30 PB 150 234

The state of progress and present capabilities in nutrition, food technology, and food service supporting equipment for manned space flight are described and evaluated in terms of future needs. The study is broad in scope. It describes feeding in very short to very long space missions. Preflight feeding provisions are described as well as partially regenerative systems and, finally, the requirements of a closed ecology are considered. A section is devoted to permissable preflight foods. Varied menus are offered for flights of short, medium, and long duration in an ascending order of variety, consumer acceptance, and support equipment. (Author)

Packaging

Arctic Aeromedical Lab., Ladd AFB, Alaska.
DETERMINATION OF PROTECTION AFFORDED BY PERISHABLE PRODUCE SHIPPING CONTAINERS, by Jack D. Douglas. June 60, 9p. Technical note AAL-TN-60-10.
Order from OTS $0.50 PB 161 975

Studies were conducted on the Federal Electric type, perishable produce shipping containers to determine the amount of protection afforded against subzero environmental temperatures. Results of the studies indicated that the containers afforded protection from ambient air temperatures as low as -40° F for periods as long as 1 hour. (Author)

Arctic Aeromedical Lab., Ladd AFB, Alaska.
SUITABLE INSULATED CONTAINERS FOR TRANSPORT OF MATERIALS HAVING CRITICAL THERMAL TOLERANCES TO HEAT, by John R. Cavanaugh. July 57, 9p. Technical note AAL-TN-57-44.
Order from OTS $0.50 PB 161 974

The container, "Chest, Plastic, Field, Insulated," Stock No. 6545 NSL, manufactured by Koch Mfg. Company was selected as the most feasible container investigated. This container and its test contents were subjected to internal temperatures ranging from +69° F. to -88° F. (estimated). During the evaluation of the "Chest, Plastic, Field" a specimen temperature below -70° F. was maintained for a period of 66 hours and 30 minutes, when the test was concluded. At conclusion of the test only 20% of the dry ice in the inner chest had sublimed. (Author)

MACHINERY, FABRICATION, AND ACCESSORY EQUIPMENT

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
STABILITY OF EXTERNALLY PRESSURIZED GAS JOURNAL BEARINGS, by Lazar Licht. Rept. on Contract Nonr-2342(00). Oct 59, 36p. 8 refs. I-A2049-8; AD-228 299.
Order from LC mi$3.00, ph$6.30 PB 149 489

A stability analysis is developed for gas journal bearings having externally pressurized pads, symmetrically spaced along the circumference. Simplifying assumptions are made and equations of flow and motion are stated in terms of perturbation quantities. The case considered is when the journal, initially in an eccentric equilibrium position, begins to move in an arbitrary direction under the influences of a small, random disturbance. Methods of factorizing and simplifying the characteristic determinants are shown, with the objective of reducing the work of examining the roots of characteristic equations. Special cases, such as the bidirectional thrust bearing and that of the journal initially in concentric position are discussed. Numerical and semi-experimental procedures of determining the coefficients of characteristic equations are outlined. Stability tests are suggested. A simple numerical example is included. Bearing parameters affecting stability are discussed. (Author)

Lincoln Lab., Mass. Inst. of Tech., Cambridge.
PRESSURE DISTRIBUTION, STABILITY, AND RESTORING TORQUE OF AN EXTERNALLY PRESSURIZED BEARING, by R. A. Greenberg. Master's thesis. Rept. on Contract AF 19(604)5200. 2 Feb 59, 20p. 3 refs. Technical rept. no. 198; AD-212 979.
Order from LC mi$2.40, ph$3.30 PB 147 587

A theoretical analysis of an externally pressurized bearing consisting of an annular disc nearly parallel to an infinite plate is conducted. The results are presented in the form of dimensionless graphs of the pressure distribution, load capacity and flow requirements of the bearing. Also, a dimensionless graph of the restoring torque of the bearing for small deflections is presented. These results indicate that maximum stability is attained for a ratio of inner diameter to outer diameter of the annulus in the range of 0.2 to 0.3. (Author)

Engines and Propulsion Systems

Air Force Missile Development Center, Holloman AFB, N. Mex.
THE LINEAR ACCELERATION OF LARGE MASSES BY ELECTRICAL MEANS, by Knox Millsaps and Karl Pohlhausen. June 60, 28p. 6 refs. AFMDC-TR-60-11.
Order from LC mi$2.70, ph$4.80 PB 150 046

The non-linear mathematical problem that is involved in the design of linear accelerators for large masses by electrodynamical reactions is discussed for the cases of battery and capacitor power sources. The influence of critical changes in the design parameters is examined by numerical and analogical integration of the equations. (Author)

Naval Weapons Lab., Dahlgren, Va.
PRESSURE, TEMPERATURE, AND NOISE MEASUREMENTS IN THE SUBSONIC REGION OF THE TERRIER GUIDED MISSILE BOOSTER MK 12 MOD O (X-240) EXHAUST STREAM, by J. F. South, R. F. Goodhart, and T. I. Dodson. 29 July 60, 46p. 2 refs. NWL rept. no. 1712.
Order from LC mi$3.30, ph$7.80 PB 149 968

The experimental results of the pressure and temperature measurements are in the form of profile and contour plots which show the pressure and temperature distributions throughout the subsonic exhaust stream region. The results of the noise level measurements are for one quadrant of a circle and show the sound pressure levels of the noise at various locations therein. (Author)

Manufacturing Equipment and Processes

Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF ELECTROPOLISHING AS A TECHNIQUE FOR PRODUCING TAPERED WIRE, by Dan B. Darden. Technical note no. 2, 1 Dec 59-29 Feb 60, on Contract AF 08(635)391. 10 Mar 60, 17p. APGC-TN-60-44.
Order from LC mi$2.40, ph$3.30 PB 149 848

Previous tests on carbon steel music wire had shown no deterioration of tensile strength after electropolishing. Further investigation has shown that the electropolished wire has fatigue strength slightly superior to the unpolished wire. Metallurgical examination of polished and unpolished wires showed some structural differences, but these could not be definitely attributed to electropolishing. Photographs of specimens are included. A schematic of a production facility for tapered wire is shown. The cost of producing the first 40,000-foot tapered wire is estimated to be about $5000. Production wires could possibly be produced for as little as $100, plus the cost of material. No further experimental work under this contract is contemplated. (Author) (See also PB 144 573)

Southern Research Inst., Birmingham, Ala.
AN INVESTIGATION OF ELECTROPOLISHING AS A TECHNIQUE FOR PRODUCING TAPERED WIRE, by Dan B. Darden. Final technical rept. for 1 May 59-1 Mar 60 on Contract AF 08(635)391. 6 May 60, 48p. 6 refs. APGC-TR-60-28.
Order from LC mi$3.30, ph$7.80 PB 149 353

Tests were run on carbon steel music wire and Type 302 stainless steel wire to determine what change in unit strength would result from electropolishing 0.050- and 0.030-inch-diameter wire down to 0.020 inch. This was to evaluate electropolishing as a technique for manufacturing a continuously tapered tow cable for aerial targets. The stainless steel wire increased in unit strength from 276,000 psi at 0.0495-inch diameter to 374,000 psi at 0.023-inch diameter. The carbon steel music wire unit strength remained substantially constant. The flexural fatique strength of the electropolised carbon steel wire was found to be slightly superior to unpolished wire. Metallurgical examination of polished and unpolished carbon steel specimens showed some structural differences, but these could not be definitely attributed to electropolishing. It is estimated that a single 40,000-foot tapered wire could be produced for about $5000, with subsequent wires for about $100 each, exclusive of materials. (Author) (See also PB 149 848)

Transport, Traction and Hoist Facilities

Airborne Instruments Lab., Inc., Mineola, N. Y.
DATA ON NEW YORK AREA AIR TRAFFIC DENSITIES, by James S. Perry. Rept. on Contract NOas-56-678-c. Jan 57, 71p. 2 refs. Rept. no. 3803-1; AD-141 226.
Order from LC mi$4.50, ph$12.30 PB 147 956

The main purpose of this report has been to examine some of the aspects of air traffic in the New York area; utilizing the air-route radar display as a data-gathering tool. The parameters explored have been: total airborne traffic counts (with category breakdowns added), relation of total airborne traffic to movement data, density distributions and track composites, sector counts, separation data, airway load rates, accuracy of fix reporting, and holding-pattern sizes.

Land Locomotion [Lab.] Ordnance Tank-Automotive Command, Center Line, Mich.
A SOIL VALUE SYSTEM FOR LAND LOCOMOTION MECHANICS, by W. L. Harrison, T. Czako and others. Dec 58, 100p. 72 refs. Research rept. no. 5; AD-218 323.
Order from LC mi$5.40, ph$15.30 PB 149 277

Contents:
Physical soil and snow values for the determination of vehicle thrust
Physical soil and snow values for the determination of vehicle motion resistance
Geometrical terrain values for the determination of vehicle's operational speed
OTAC instruments for the measurement of physical soil values
The Caterpillar Corp. instruments for the measurement of physical soil values
Instrumentation for the measurement of terrain geometry
Techniques of soil measurement
Practical significance and applications of the physical soil value system
Rigid wheel performance
Prediction of rigid wheel sinkage
Rolling resistance of pneumatic tires in soft soils
Drawbar pull of tracked vehicles
Wheels in viscous mud
Physical soil values in relation to moisture content and soil composition

Soil values and a definition of soil trafficability and vehicle mobility
Prediction of the WES Cone Index by means of land locomotion soil values.
Classification of soils and the significance of their parameters in land locomotion
Soil values and their measurements in the Soviet block

MATERIALS

Aeronautical Materials Lab., Naval Air Material Center, Johnsville, Pa.
INVESTIGATION OF THE EFFECTS OF VOLATILE CORROSION INHIBITORS ON MIL-B131C BARRIER MATERIALS, by D. Minuti and I. H. Custis. Final rept. on Proj. TED NAM AE 42144. 29 Jan 60, 13p. 3 refs. Rept. no. NAMC ANL AE 1105; AD-234 825L.
Order from LC mi$2.40, ph$3.30 PB 149 525

Investigation of the compatability of MIL-B-131C barrier materials with volatile corrosion inhibitors revealed that Type I volatile corrosion inhibitor-treated carriers had little or no effect on the water vapor transmission rate of MIL-B-131C barriers, although the resealability of some vinyl-faced barriers was affected. Type II materials caused delamination of all the polyethylene as well as a vinyl-faced barrier with resultant higher water vapor transmission rates. (Author)

Army Chemical Warfare Labs., Army Chemical Center, Md.
MATERIALS REVIEW NO. 7, by Arthur Lyem. May 60, 101p. 330 refs. CWL Special Publication 4-18.
Order from OTS $2.50 PB 161 971

Three hundred and thirty articles from various journals have been abstracted. The review is broken down into five major headings: (1) high polymers, (2) plastic materials, (3) synthetic fibers, (4) metals and inorganic materials, and (5) miscellaneous and new concepts. (Author) (See also PB 161 463)

[Army] Signal [Research and Development Lab.] Fort Monmouth, N. J.
THE DEVELOPMENT OF SNOW MANUFACTURING TECHNIQUES BY USE OF CLIMATIC TEST COLD ROOMS, by Alexander J. Brickler. Rept. on Operation Snowflake. 4 Dec 48, 22p. 5 refs. Engineering rept. no. 1032.
Order from LC mi$2.70, ph$4.80 PB 150 685

This report released for sale to the public 11 Oct 60.

Snow can be made in limited quantity in the cold rooms of the Climatic Test Laboratory by the chilling of moisture clouds formed from steam injected into the rooms. The process can be made continuous so that a snow fall of approximately 3 inches can be produced by a 36 hour run. (Author)

Massachusetts U., Amherst.
SOME MECHANICAL AND OPTICAL PROPERTIES OF CFN POLYMERS, by H. Kawai and R. S. Stein. Technical rept. no. 16 on Contract Nonr-2151(00). 15 Oct 59, 19p. 12 refs. AD-232 563.
Order from LC mi$2.40, ph$3.30 PB 149 482

SC-CFN-GBV polymer, prepared from single sublimed R_f butyro amidine and R_f glutaro imidine obtained from doubly distilled R_f glutaro nitrile, was heat-treated and hot-pressed between aluminum foil and cellophane. The starting mole ratio was 1.3 butyro amidine to 1 glutaro imidine. A continuous and translucent circular film of the polymer laminate was obtained by a special casting technique. The diameter and thickness of the film was about 5 and 0.02 cm, respectively. The mechanical and optical properties of the polymer film were measured simultaneously at various temperatures, the former being measured by a modified instron tensile tester and the latter by an optical system which crosses the polymer film at various angles of 90^{o} to 45^{o}. Data indicated that the stress relaxation at $33^{o}C$ was small and reached an equilibrium beyond about 10 min. The equilibrium stress was proportional to the applied strain at least within 20% strain. A check was made on the ideal rubber elasticity behavior. The number of cross links/cc, N_c, calculated from the inclination of the straight line portion (within the strain of 9%) was 2.58×10^{19}/cc. The apparent value of N_c was determined as 2.02×10^{19}/cc, indicating that the number of effective cross-links decreases slightly beyond the strain of 10%. The birefringence change decreased in an earlier stage and then increased. The increase appeared earlier when the strain was greater.

Minnesota U., Minneapolis.
RHEOLOGICAL PROPERTIES OF ADHESIVES CONSIDERED FOR INTERFACE DAMPING, by J. S. Whittier. Rept. for June 57-Dec 59 on Metallic Materials, Contract AF 33(616)6828. June 60, 70p. 10 refs. WADD Technical rept. 60-280.
Order from OTS $1.75 PB 171 023

Machines for testing soft adhesives under static compression and shear and under dynamic shear are described. Static creep data in compression and shear are reported for Minnesota Mining and Manufacturing Company's 3M Tape #466. At a given compressive load this material deforms, after sufficient time has elapsed, to an "equilibrium" thickness. Dynamic shear data for 3M Tape #466 are reported for frequencies from 0.1 to 120 cps and for shear strain amplitudes from zero to unity and greater. Stress history and fatigue effects are also mentioned. This material is found to dissipate large amounts of specific damping energy when undergoing safe dynamic shear strains. Spot checks on the dynamic shear properties of three other materials at 11.5 cps are also presented. The terms used for data presentation are explained in the report by giving data reduction formulas. (Author)

Naval Civil Engineering Lab., Port Hueneme, Calif.
CORAL AND CORAL CONCRETE, by William R. Lorman. Final rept. 13 Apr 60, 57p. 22 refs. Technical rept. 068.
Order from LC mi$3.60, ph$9.30 PB 149 232

This manual describes and defines coral reefs, beaches, and elevated formation; presents salient features relative to prospecting for suitable coral deposits, extracting coralline limestone, and processing and stockpiling the aggregate; summarizes findings concerning such physical properties of coral aggregate as bulk density, specific gravity, and absorption; furnishes typical coral concrete mix-proportion data together with anticipated strength values. (Author)

Rodman Lab., Watertown Arsenal, Mass.
APPLICATION OF THE DIGITAL COMPUTER TO MICROHARDNESS DETERMINATION, by K. D. Holmes, E. Deluca, and G. D. Pinching. Apr 60, 9p. 2 refs. Rept. no. RPL 10/24.
Order from LC mi$1.80, ph$1.80 PB 149 571

A simplified method for determining Knoop or Diamond Pyramid microhardness numbers is established by using the digital computer to convert the measured length of the microhardness impression directly to its corresponding hardness number. Numerical tables are set up which eliminate operator calculations, thereby considerably reducing the time and effort necessary for obtaining a microhardness number. (Author)

Ceramics and Refractories

Battelle Memorial Inst., Columbus, Ohio.
CHARACTERISTICS GOVERNING THE FRICTION AND WEAR BEHAVIOR OF REFRACTORY MATERIALS FOR HIGH-TEMPERATURE SEALS AND BEARINGS, by Lewis B. Sibley, Arthur E. Mace and others. Rept. for 1 Mar 58-31 May 59 on Ceramic and Cermet Materials, Contract AF 33(616)3995. May 60, 54p. 4 refs. WADD Technical rept. 60-54.
Order from OTS $1.50 PB 171 010

Various ceramic and cermet materials have been evaluated for unlubricated wear resistance at high sliding speed (100 to 200 fps) and low unit load (5 to 50 psi) in 1000 to 1800°F air. A statistical correlation was obtained between the measured wear rates under these conditions and the coefficient of friction, the thermal-stress-resistance, and the thermal diffusivity of the mated materials on which wear predominated. A mechanism of wear has been evolved based on the above correlation and on the experimental study of friction and wear surface-temperature fluctuations using special transducers and color-motion-picture photography. During high-speed sliding wear appears to be induced by the inability of ceramic and cermet materials to resist thermal stresses produced by temperature gradients within each rubbing surface between small asperities or hot spots in frictional contact and the body of the respective materials. In this situation, the wear rate is influenced both by the configuration of the rubbing parts and by the thermal-stress-resistance properties of the materials. Promising materials for high-temperature high-speed sliding bearings and seals include Al_2O_3-Cr-Mo cermets, SiC ceramics, and TiC-Ni-Mo cermets. (Author)

Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF METHODS AND INSTRUMENTS FOR MECHANICAL EVALUATION OF REFRACTORY MATERIALS AT VERY HIGH TEMPERATURES, by D. H. Fisher, D. N. Gideon and others. Rept. for 1 Feb 59-31 Mar 60 on Metallic Materials, Contract AF 33(616)6155. June 60, 82p. 79 refs. WADD Technical rept. 60-155.
Order from OTS $2.25 PB 171 012

A mechanical-testing system has been established which is capable of providing tensile and compressive stress-strain data and shear-strength data up to 400 F in vacuum. The results of an evaluation of the system using a molybdenum-0.5 percent titanium alloy in the bar form are presented. Tension, compression, shear and bearing tests were conducted at temperatures up to 3500 F. A detailed description of the testing system and specimen designs is presented. An optical strain-measurement system which permits displacements to be measured directly in the gage section is described. The state-of-the-art report on the development of equipment and techniques of mechanical-properties measurement is based on a survey of literature and discussions with researchers at Battelle and other laboratories. With the objective of developing equipment and technique for use to 6000°F or higher problems to be solved in order that accurate data will be obtained are considered. Recommendations are made concerning furnace design, temperature and strain measurement, and specimen, grip and loading design. In particular, the probable advantages of graphite heaters coated with tantalum carbide are pointed out. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
STRAIN AGING OF REFRACTORY METALS, by A. G. Imgram. Rept. on Contract AF 18(600)1375. 12 Aug 60, 64p. 47 refs. DMIC rept. no. 134.
Order from OTS $1.75 PB 151 092

The available data on strain-aging behavior of 12 refractory metals (V, Cb, Ta, Cr, Mo, W, Ru, Rh, Pd, Os, Ir, and Pt) are reviewed and interpreted in terms of dislocation models. (Author).

Fuels, Lubricants, and Hydraulic Fluids

Aerojet-General Corp., Azusa, Calif.
THE ROLE OF BINDER IN COMPOSITE PROPELLANT COMBUSTION, by R. F. Chaiken and W. H. Andersen. Rept. on Contract AF 49(638)566. July 59, 26p. 16 refs. Aerojet rept. no. TN-30; ARPA Order no. 24-59, Task 2; AFOSR TN-59-540; AD-228 340.
Order from LC mi$2.70, ph$4.80 PB 149 772

The interrelation of binder (fuel) and oxidizer during burning of conventional types of solid composite propellants is discussed in terms of the mechanism of the

combustion process. A major feature of most contemporary theories of composite propellant combustion is that diffusion processes are involved in the chemical reactions between the gaseous pyrolysis products of the oxidizer and binder. However, the importance of these diffusion processes in affecting the propellant-burning characteristics depends upon the relative rates of reaction between the oxidizer-binder pyrolysis products and the oxidizer pyrolysis products alone. Utilizing the recently developed "Two-Temperature" and "Thermal Layer" theories of combustion, it is possible to delineate the various effects of these gaseous reactions on the propellant burning rate. These theories have been extended semi-quantitatively to include the effects of dilution, diffusion, and fast chemical reaction of the gasified binder. The combustion of ammonium nitrate and ammonium perchlorate propellants is discussed in terms of the described concepts, and compared with experimental data where possible. Evidence is presented which suggests that the "order-of-magnitude" burning rates of most ammonium-nitrate-based propellants should be determined largely by the chemical decomposition behavior of the oxidizer, with the binder decomposition playing a secondary role. It is not clear that the same situation holds for ammonium-perchlorate-based propellants. (Author)

Air Force Missile Development Center, Holloman AFB, N. Mex.
A TRACER METHOD FOR BURNING RATE MEASUREMENT IN SOLID-PROPELLANT MOTORS, by F. G. Penzig. Aug 60, 24p. 5 refs. AFMDC-TN-60-8.
Order from LC mi$2.70, ph$4.80 PB 150 045

Problems associated with the development of large, solid-propellant rockets are discussed. A new diagnostic method is proposed whereby tracers are imbedded into the grain and are released when the burning zone has reached their particular location. The release is recorded by spectroscopic monitoring of the exhaust flame of the rocket. Consequently, the method permits measurement of the actual burning rate of the propellant in a rocket motor. Research is proposed on the selection of suitable elements and compounds as tracers measurement of the line or band intensity as a function of temperature and concentration, and the ability of spectroscopic signals at low temperature and against background radiation. This study concentrates on the applicability of the method. A number of readily available tracer substances are discussed, including applicability of the method to advanced propellants with high background radiation. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
INTRODUCTION TO SOLID-PROPELLANT THERMAL PROPERTY SCALING THEORY, by Ralph D. Doner. 12 Oct 59, 12p. 4 refs. ARGMA TN 1 G4N; AD-227 628.
Order from LC mi$2.40, ph$3.30 PB 149 440

Some implied scaling relations between solid symmetric bodies found in the literature on heat transfer are analyzed and exhibited. A suggested approach to the task of establishing a scaling theory for solid-propellant grain configurations is to extend the theory for solid bodies to include hollow cylinders, and then, by computation and physical tests, find the hollow cylinder equivalent for each type of configuration. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
EVALUATION OF PROPELLANT STABILITY BY OXYGEN TALIANI TEST AND CHEMICAL ANALYSIS, by L. DeAngelis and G. F. Gardin. Aug 59, 14p. 11 refs. Memo. rept. no. 1129; AD-228 834.
Order from LC mi$2.40, ph$3.30 PB 150 297

The oxygen Taliani Test has been extended to measure the chemical stability of single base propellants. The results correlate well with chemical analysis of propellant stabilizer and stabilizer reaction products. The findings were made by aging propellant samples at 80°C, a temperature previously considered too high for obtaining reliable stability data. However, evidence is presented to show that the principal chemical reactions between propellant and stabilizer at this temperature can be considered similar to those occurring at ambient temperatures. Accelerated aging at 80°C and the Oxygen Taliani Test have been used to make quantitative measurements of chemical stability for single base propellants. (Author)

Battelle Memorial Inst., Columbus, Ohio.
A STUDY OF THE TITANIUM-LIQUID OXYGEN PYROPHORIC REACTION, by J. D. Jackson, P. D. Miller and others. Rept. for 1 June 59-15 Feb 60 on Metallic Materials, Contract AF 33(616)6345. June 60, 59p. 29 refs. WADD Technical rept. 60-258.
Order from OTS $1.50 PB 171 017

A review of the literature indicates that titanium is impact sensitive under liquid oxygen below the acceptable limit for other metals. An experimental program was begun to determine the mechanism of the titanium-LOX reaction. Several factors were investigated singly in a controlled manner using unalloyed titanium (75A) and an alloy (6Al-4V) that were carefully cleaned. The factors were: (1) Exposure of a fresh surface by fracture and tearing (2) Deformation by impact using steel balls (3) Impact of smooth specially cleaned flat surfaces (4) LOX pressure and velocity (5) Galling. The results from this program indicate that no one of the above, per se, is a primary cause of this reaction. A proposed mechanism is that heat generated by impact produces gaseous oxygen, which is compressed at local sites. A fresh surface exposed by the impact reacts with the high-pressure gaseous oxygen. Propagation is dependent on the amount of heat generated and the rate of heat loss from the affected area. (Author)

Bureau of Mines, Washington, D. C.
THE FISCHER-TROPSCH SYNTHESIS ON THE OIL-CIRCULATION PROCESS: EXPERIMENTS WITH A NITRIDED FUSED-IRON CATALYST, by D. Bienstock, J. H. Field and others. [1960] 37p. 23 refs. Rept. of Investigations 5603.
Order from LC mi$3.00, ph$6.30 PB 146 767

Using a nitrided fused-iron catalyst, the Bureau of Mines investigated the Fischer-Tropsch reaction in the oil-circulation process. The nitrided iron was

quite stable and permitted the longest run obtained thus far in the oil-circulation process without the need for reactivating the catalyst--3,700 hours of operation. The effects of several operating variables--temperature, pressure, gas-recycle ratio, space velocity, synthesis-gas composition, and synthesis with and without reflux of oil to the reactor--on the production of oxygenates were studied. The importance of removing reflux oil and of high gas recycle in increasing the oxygenate content was shown. A finished gasoline containing 28 percent by weight alcohols was produced. The research octane number (RON) was 92.9 clear, increasing to 98.5 with the addition of one milliliter of tetraethyl lead (TEL). (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
FLAME PROPAGATION IN LIQUID-FUEL DROPLET ARRAYS, by R. Reichenbach, D. Squires, and S. S. Penner. Technical note no. 30 on Contract DA 04-495-ORD-1634; Continuation of Contract DA 04-495-ORD-446. June 60, 18p. 2 refs. OOR rept. no. no. 834.43-C.
Order from LC mi$2.40, ph$3.30 PB 150 402

Flame propagation rates have been determined in one-dimensional arrays of liquid octane droplets burning in air without forced convection. Schlieren photographs of the burning array show the importance of immersion depth in the heated gas region for ignition and flame propagation. The measured flame propagation times for various droplet sizes and droplet spacings are proportional to (immersion depth)$^{-1.5}$. A tentative explanation is proposed for these results. (Author)

Guggenheim Jet Propulsion Center, Calif. Inst. of Tech., Pasadena.
RADIATION AND BURNING VELOCITIES OF PROPANE-OXYGEN-NITROGEN MIXTURES, by R. Reichenbach. Technical rept. no. 31 on Contract DA 04-495-ORD-1634. June 60, 30p. 20 refs. OOR rept. no. 834-42-C. AD-239 907.
Order from LC mi$2.70, ph$4.80 PB 150 397

Experiments have been conducted with inert diluent contents (by mass) of 50, 60, 70 and 80 percent nitrogen and with equivalence ratios of 0.6, 0.8, 1.2, 1.4 and 1.6. The spectral intensity ratio was found to be a function not only of the equivalence ratio but also of the percentage of inert diluent. Hence it is not possible, in general, to use spectral intensity ratios as a measure of mixture composition, a procedure that has been used erroneously by a numer of investigators. (Author)

Lockheed Aircraft Corp., Sunnyvale, Calif.
OPTIMUM PROGRAMMING OF PROPELLANTS TO OBTAIN MAXIMUM VELOCITY FROM A TWO-STAGE ROCKET, by Jean Parks and R. H. Olds. Technical rept. Nov 59, 49p. 4 refs. LMSD-288047; AD-231 037.
Order from LC mi$3.30, ph$7.80 PB 148 942

Previous studies have shown that certain combinations of two propellants with significantly different densities and specific impulses will propel a given single-stage rocket to a final velocity greater than that obtainable from the use of either propellant alone. This report extends the investigation to the treatment of a two-stage rocket employing four different propellants, two different propellants in each stage. A method is presented for determining the optimum mode of varying the propellant mixture ration during burning so as to achieve the maximum possible velocity from the two-stage rocket.

Massachusetts Inst. of Tech., Cambridge.
INTERACTIONS AMONG BURNING FUEL DROPLETS. I. A SINGLE FUEL PLATE, by Tau-Yi Toong. Rept. on Contract AF 49(638)629. 31 May 60, 26p. 7 refs. Technical rept. no. 8227-1; AFOSR-TN-60-516; AD-239 513.
Order from LC mi$2.70, ph$4.80 PB 149 461

This is the first of a series of papers, intended to discuss the basic causes and mechanisms of the interactions among burning fuel droplets and their effects on over-all burning rate and combustion stability and roughness in a combustor employing fuel sprays. The boundary-layer equations governing the flow of an oxidizer over a flat plate covered with fuel are solved for a special case, where the flame front can be treated as a discontinuity. The results presented include the profiles of velocity, composition and temperature in the boundary layer adjacent to the fuel plate as well as the evaporation or sublimation rate at the fuel surface and the combustion rate at the flame front. For a given fuel-oxidizer combination and for a given heat transfer required to evaporate (or sublime) one unit mass of fuel, both the evaporation (or sublimation) and the combustion rates per unit plate area and per unit mass velocity of the oxidizer in the free stream are inversely proportional to the square root of the length Reynolds number. With increasing values of the heat ratio, they both increase at a given length Reynolds number, although the ratio of the combustion to evaporation (or sublimation) rates decreases. This latter observation indicates the possibility of a long over-ventilated flame near the wake of a burning fuel droplet. (Author)

Massachusetts Inst. of Tech., Cambridge.
INTERACTIONS AMONG BURNING FUEL DROPLETS. II. TWO PARALLEL FUEL PLATES, by Tau-Yi Toong. Rept. on Contract AF 49(638)629. 31 May 59, 20p. 4 refs. Technical rept. no. 8227-2; AFOSR-TN-60-517; AD-239 669.
Order from LC mi$2.40, ph$3.30 PB 149 462

The interactions between two parallel fuel plates burning in an oxidizer stream are studied by the use of an integral method. Within the region of validity of this method, where the flames adjacent to the plates are separated from each other, the evaporation or sublimation rate at the fuel surface increases with decreasing spacing between the plates, while, in the meantime, the combustion rate at the flame front decreases. These interactions become less important with decreasing value of the heat ratio. Applying the results obtained in this work to the case of two fuel droplets burning side by side, one would predict an increase in both the burning rate and the flame length with decreasing droplet spacing, as long as the flames surrounding the droplets are separated from each

other. These predictions are found to agree well with the experimental results, which will be presented in the third paper of this series. (Author) (See also PB 149 461)

Naval Research Lab., Washington, D. C.
THE STABILIZATION OF SILICONE LUBRICATING LIQUIDS ABOVE 200°C. PART 2. IRON, COPPER, CERIUM, AND OTHER METAL COMPOUNDS, by H. R. Baker and C. R. Singleterry. Interim rept. 12 Aug 60, 27p. 5 refs. NRL rept. 5474.
Order from OTS $0.75 PB 161 449

Silicone liquids have been stabilized against oxidation and gelation so that the useful life at 325°C or below is lengthened 30- to 500-fold over the original oil. The stabilization is accomplished by treating the silicone oil with a cerium soap in the presence of disalicylalpropylenediamine, or a related chelating compound, at 285°C. Similar but less effective stabilization occurs when the cerium soap is replaced by suitable iron, copper, chromium, praseodymium, or europium compounds. This treatment is effective with dimethyl silicones and also with phenyl-substituted types. The percentage improvement obtainable with the phenylated oils decreases with increasing aromatic content; after inhibition the lightly phenylated oils, which have excellent viscosity-temperature characteristics, have as long a life as the highly phenylated oils, heretofore found most stable in high-temperature service. Also, the volatile products of silicone oxidation at 300°C promote premature gelation if they are returned to the liquid under test.

Nonmetallic Materials Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
HIGH TEMPERATURE HYDRAULIC FLUIDS. PART I. CHEMICAL DEGRADATION IN A HIGH TEMPERATURE, HIGH PRESSURE CIRCULATION LOOP, by Leslie R. Drane, Jr. and R. J. Benzing. Rept. on Power Transmission Technology. May 60, 20p. 6 refs. WADD Technical rept. 60-250, Part I.
Order from OTS $0.50 PB 161 965

A study was made to observe the nature and intensity of chemical degradation resulting from severe mechanical shearing stresses at elevated (400°F) temperature. The degradation of these four fluids (two silicones, a silane, and an alkoxy disiloxane) were also studied under static thermal conditions. The physical and chemical properties, particularly viscosity, neutralization number, and flash point showed changes in direction of values with time. Possible mechanisms of break-down to explain observed differences between the static and dynamic tests are discussed. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
EVAPORATION AND BREAKUP OF FUEL DROPLETS IN ONE-DIMENSIONAL GAS FLOW IN A COMBUSTION CHAMBER, by Leonard M. Naphtali and Samuel Z. Burstein. Rept. on Contract AF 49(638)165. Jan 60, 21p. 6 refs. PRL-60-2; AFOSR-TN-60-229; AD-233 498.
Order from LC mi$2.70, ph$4.80 PB 148 999

A mathematical model was formulated of combustion in a rocket motor as controlled by the evaporation process of an arbitrary number of droplets of injected fuel. It was assumed that interaction between single droplets was negligible and that evaporation rates of a distribution of droplets were additive. The results of the evaporation of the fuel droplets were weighed to yield a mass rate flow which was consistent with the conditions in a combustion chamber producing a thrust of about 25,000 lb. The model was programmed as a Fortran II subroutine for the IBM 704. Computations revealed that under a wide range of conditions a cooperative breakup occurred, in which the increased velocity of gases caused droplet breakup, which further increased evaporation. As a result, the overall evaporation occurred suddenly in a narrow zone in the combustion chamber where the velocity gradient was high. It was concluded that droplet breakup was the most important single parameter in spray combustion. The combustion zone tended to be narrow and relatively insensitive to size distribution, mass drop size, velocity, or temperature of the liquid.

Research Inst., Temple U. Philadelphia, Pa.
RESEARCH STUDY OF THE OXYGEN FLUORIDES, O_2F_2, O_3F_2 AND O_4F_2, INCLUDING THE HEATS OF FORMATION OF O_2F_2 AND O_3F_2, by A. D. Kirshenbaum, J. G. Aston, and A. V. Grosse. Final rept. on Contract DA 36-034-ORD-2250. 18 Nov 58, 51p: 33 refs; AD-212 168.
Order from LC mi$3.60, ph$9.30 PB 149 443

Contents:
Physical and chemical properties of the oxygen fluorides
Heat of formation of O_3F_2 and O_2F_2
Discussion of possible structures of O_2F_2 and O_3F_2
Infrared analysis of O_2F_2

Rocketdyne, Canoga Park, Calif.
DISPLACEMENT AND SHATTERING OF PROPELLANT DROPLETS, by E. Rabin, A. R. Schallenmuller, and R. B. Lawhead. Rept. on Contract AF 18(603)98. Mar 60, 124p. 20 refs. R-2431; AFOSR-TR-60-75.
Order from LC mi$6.30, ph$19.80 PB 150 143

Studies in shock tubes have been conducted to determine the effect of shock waves on the shattering and drag of burning and nonburning liquid fuel droplets. The effect of flow velocity, flow duration, surface tension, and chamber pressure on the breakup characteristics were studied. The critical velocity that would just cause droplet breakup (burning or not) for short-duration flow was found to agree with the equation: $We\,Re^{-1/2} \simeq 0.45$. The drag coefficient for burning and nonburning drops was found to be approximately $C_D = 1.0$.

Leather and Textiles

Fabric Research Labs., Inc. [Dedham, Mass.]
A POSSIBLE APPLICATION OF ORGANIC FIBERS IN HIGH TEMPERATURE ENVIRONMENT, by Myron J. Coplan, Donald H. Powers, Jr. and others. Rept. for Mar-Dec 59 on Air Force Textile Materials, Contract AF 33(616) 6234. June 60, 137p. 90 refs. WADD Technical rept. 60-9.
Order from OTS $2.75 PB 171 020

It is taken as a premise that fabrics used in re-entry drag parachutes (1) require typical textile properties up to deployment but (2) that they need not survive in their original chemical state subsequent to deployment provided the decay occasioned by re-entry conditions (heat, active oxygen, irradiation) does not interfere with the deceleration function. The possible utility of linear organic polymers as the principal chemical species in such materials is examined. Typical organic, metallic and ceramic materials are contracted and the advantages of organic materials are defined. Recognizing that the principal deficiencies of organic polymer fibers are their thermal and thermochemical sensitivity, a survey of their causes is given. A means of employing materials by taking advantage of their thermal degeneration is proposed. A number of specific thermo-chemical reaction schemes and polymer systems are proposed. More experimental effort is required to assure the feasibility of any of the specific schemes proposed. (Author)

Naval Supply Research and Development Facility, Bayonne, N. J.
REFLECTIVE INSULATION IN FABRIC SYSTEMS, by John J. Anderson and George Higginbottom. Sep 59, 21p. 5 refs. Clothing and Textile Div. rept. no. 44.
Order from LC mi$2.70, ph$4.80 PB 146 975

Several fabric systems employing thin metal films which act as far infra-red barriers were tested for conductance and compared against the conductance of the fabric system used in Navy extreme cold weather clothing. Conductance was measured at sea level, 20,000 and 40,000 feet simulated altitude. Metallized fabrics separated by an open mesh spacer provide good insulation comparable to conventional fibrous systems of equal thickness and are lighter in weight. (Author)

Quartermaster Research and Engineering Center, [Natick, Mass.]
DEVELOPMENT OF SHADE STANDARDS AND TOLERANCES FOR SILVER TAN 193, by Frank J. Rizzo, Constantine J. Megas and others. Rept. for 9 Apr 53-15 Apr 58 on Air Force Textile Materials, Contracts AF 33(616)53-221 and AF 33(616)54-107. June 60, 123p. 25 refs. WADD Technical rept. 60-151.
Order from OTS $2.75 PB 171 011

Shade standards and tolerances have been developed for tropical and gabardine weave fabrics in all wool, wool/polyester and polyester/rayon blends. Tolerance spacing is such as to permit interchange of uniform components made for the blend fabrics with components made of all wool so long as the weave construction is common. The limiting factor to such usage is considered to be differences in appearance originating with the gloss of the fibers and not the chromatic and lightness deviations of the tolerance range. Colorfastness is good at 50 Standard Fading Hours for all fabrics, except for the polyester/rayon tropical where the vat dyed rayon permits a rating of good at 120 Standard Fading Hours. Dye formulations selected are practical for routine application and stable to finishing factors. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
EFFECT OF PICKS PER INCH AND FINISHING PROCEDURES ON THE PROPERTIES OF 1.1-OUNCE NYLON RIPSTOP PARACHUTE FABRIC, by Harold H. Brandt and Leo Linden (Warwick Mills). June 60, 54p. 18 refs. Textile Series rept. no. 113.
Order from LC mi$3.60, ph$9.30 PB 150 265

This report presents the production and laboratory evaluation of 1.1-ounce nylon ripstop fabrics produced with different picks and finished by two different sequences of the finishing operations. It is believed that the information contained in this report will be of value to the textile industry as well as to the military in the production of a nylon canopy fabric which will possess an adequate air permeability during the life of the parachute. (Author)

Paints and Finishes

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
ANALYSIS OFAUTOMOTIVE METHACRYLATE LACQUERS, by M. H. Swann. 20 June 60, 8p. 2 refs. CCL #95.
Order from LC mi$1.80, ph$1.80 PB 149 961

The basic resinous portion of the new acrylic automotive lacquers is an alkyl ester of methacrylic acid. They are blended with nitrocellulose and suitable plasticizers in the approximate ratio of 12:4:1 parts by weight. Procedures for measuring the methacrylate resins in typical mixtures of this type have not been available. Use is made of the difference in resistance to saponification to isolate the methacrylate resins. (Author)

Coating and Chemical Lab., Aberdeen Proving Ground, Md.
GEL-TYPE, VERTICAL ADHERENCE PAINT REMOVERS, by A. Mankowich. Rept. no. 1, 20 July 60, 13p. 1 ref. CCL #94.
Order from LC mi$2.40, ph$3.30 PB 149 420

A heavy duty, single phase, alkaline-organic solvent paint remover, formulated during the development of medium pH strippers suitable for use on missile component parts of aluminum, can be converted into stable, vertical adherence strippers by gelling with metallic soaps. A method of preparing the gels has been devised. While such removers are transformed into two liquid layers at 155° F and frozen solid at -40°F, they regain their original consistency and adhesiveness at room temperature. Low alkalinity compositions of this type, suitable for use on aluminum basis metals from the non-corrosivity standpoint, are unsuitable because of almost zero stripping efficiency.

Plastics

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DETERMINATION OF LONG TERM BEHAVIOR OF EXTRUDED PLASTIC PIPE FROM BURST STRENGTH TESTS, by S. Goldfein. 29 July 59, 28p. 11 refs. Rept. 1590-TR; AD-226 688.
Order from LC mi$2.70, ph$4.80 PB 150 199

Four types of thermoplastic pipe were investigated. These included high-density polyethylene, acrylonitrile-butadiene-styrene, high-impact polyvinyl chloride, and normal polyvinyl chloride pipe. Master rupture curves were obtained by plotting hoop stress versus the parameter. The master curves so obtained were then used to predict rupture properties for periods of time from 0.1 hour to 45,000 hours. Good accuracy was obtained by this method. It is concluded that: (a) The parameter $K = \frac{T_0 T}{T_0 - T}(20 + \log t)$, where T_0 = zero strength temperature (degrees R), and t = time (hours), may be used to determine long-term operating pressures of thermo-plastic pipe using burst strength tests at elevated temperatures. (b) The value of zero strength temperature may be determined from molding temperature data or extrapolation of strength-temperature curves, whichever is more feasible. (Author)

Army Engineer Research and Development Labs., Fort Belvoir, Va.
DEVELOPMENT OF NONDESTRUCTIVE TEST FOR PLASTICS, by S. Goldfein. 16 May 60, 49p. 2 refs. Technical rept. 1633-TR.
Order from LC mi$3.30, ph$7.80 PB 150 231

An investigation was made to determine whether a penetration type test could be developed as a nondestructive test for determining the strength of plastic materials and items fabricated from plastics. A penetrator having a circular cross section .130 in. in diameter was forced into 17 different plastic materials. The characteristics of the penetration load-penetration depth curves were studied, as well as the progressive damage to the plastics. Many useful relationships were established, including a relationship between penetration index (a property easily determined with no mark or effect on the material) and the following properties: tensile, shear, and compressive strengths, and tensile modulus. The method is limited to materials and items under which a steel backup plate can be placed. It is concluded that: (a) a mechanical, nondestructive test method based on a penetration test has been developed for use with all types of plastics; (b) new properties designated as penetration proportional limit, penetration strength, and penetration index may be useful in characterizing plastic materials for design or inspection purposes; (c) the test may presently be performed in the laboratory rapidly and with little cost. (Author)

Army Prosthetics Research Lab., Washington, D. C.
A METHOD FOR THE DETERMINATION OF SOIL RESISTANCE OF POROUS LAMINATES, by William C. Wiedman and James T. Hill. June 59, 11p. 1 ref. Technical rept. no. 5932; AD-220 610.
Order from LC mi$2.40, ph$3.30 PB 147 818

A preliminary investigation is described of a method for soiling and cleaning porous laminates. The process consists of blowing finely powdered charcoal on the surface of a laminate sample, measuring its reflectance value on a Color Difference Meter and then cleaning the sample with a stream of air. (Author)

Feltman Research Labs., Picatinny Arsenal, Dover, N. J.
ULTRA-HIGH RESISTANCE MEASUREMENTS OF PLASTICS, by Andrew R. Blanck. Aug 60, 14p. 4 refs. Technical rept. FRL TR-6.
Order from OTS $0.50 PB 161 784

A method has been developed for measuring resistances greater than 10^{16} ohms. This method is based on the use of a voltage divider integrating circuit in conjunction with commercially available high-input impedance electrometers. Accuracy of the technique was confirmed by testing a resistor with a certified value of 10^{13} ohms. The ability to measure these extremely high resistance values is necessary for determining the resistivities of low-loss dielectrics such as Teflon, polystyrene, Mylar, and some epoxies and for determining the insulation resistance and leakage of components and electrical equipment. Teflon was found to have a volume resistivity of 5×10^{19} ohm-cm at a potential gradient of 5 volts/mil and 5×10^{20} ohm-cm at .05 volt/mil. (Author)

Naval Research Lab., Washington, D. C.
PHOTODEGRADATION OF HIGH POLYMERS. PART I. THE HOMOGENEOUS IONIC POLYMERIZATION OF α-METHYLSTYRENE, by R. B. Fox and L. Isaacs. 19 Aug 60, 11p. 30 refs. NRL rept. 5518.
Order from LC mi$2.40, ph$3.30 PB 147 965

A practical method has been developed for the laboratory preparation of poly-α-methylstyrene. The procedure involves the reaction of α-methylstyrene with sodium in tetrahydrofuran solution at a temperature above the ceiling temperature for the monomer concentration used and propagation by cooling to -78°C. All operations are conducted under helium. Optical densities of the solutions just prior to cooling are related empirically to the intrinsic viscosities of the polymers produced, and viscosities are given as a function of polymerization time for a fixed solution optical density. Relatively mono-disperse polymers with predictable molecular weights in the range of 50,000 to 1 million were prepared. Their molecular weight distributions were compared qualitatively by sedimentation methods with those obtained by heterogeneous sodium initiation and boron trifluoride etherate initiation. (Author)

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
THE PYROLYSIS OF PLASTICS IN A HIGH VACUUM ARC IMAGE FURNACE, by Henry L. Friedman. Rept. on Contract AF 04(647)269. May 60, 39p. 7 refs. Technical Information Series R60SD380.
Order from LC mi$3.00, ph$6.30 PB 150 288

An apparatus is described for high vacuum pyrolysis of plastics in an arc-image furnace. A fractionation and analysis scheme is presented, whereby the complex mixture of pyrolysis products may be analyzed accurately. The design of a new gas chromatography valve is included. This experimental approach is able to yield a very complete picture of the chemical composition of pyrolysis products. The rate data were not as accurate as the chemical analyses. The data which may be obtained from such experiments will be useful for ablation studies and for gaining insights to the mechanism of thermal degradation of plastics. (Author)

MATHEMATICS

Applied Mathematics and Statistics Labs., Stanford U., Calif.
BANACH ALGEBRAS WITH SCATTERED STRUCTURE SPACES, by Irving Glicksberg. Technical note no. 13 on Contract AF 49(638)294. 11 Aug 60, 16p. 14 refs. AFOSR-TN-60-805.
Order from LC mi$2.40, ph$3.30 PB 150 107

Applied Mathematics and Statistics Labs., Stanford U., Calif.
CRITERIA FOR THE RECURRENCE OR TRANSIENCE OF STOCHASTIC PROCESSES. I, by John Lamperti. Technical rept. no. 16 on Contract Nonr-225(28). 14 Oct 59, 28p. 8 refs. AD-227 372.
Order from LC mi$2.70, ph$4.80 PB 149 949

Applied Mathematics and Statistics Labs., Stanford U., Calif.
PREDICTION REGIONS FOR SEVERAL PREDICTIONS FROM A SINGLE REGRESSION LINE, by Gerald J. Lieberman. Technical rept. no. 42 on Contract N6onr-25126. 10 Oct 59, 14p. 1 ref; AD-227 879.
Order from LC mi $2.40, ph$3.30 PB 149 942

Two methods, the exact method and the approximate method, are given for obtaining a prediction region for future observations based upon the same estimated linear regression given the values of the independent variables. (Author)

Applied Mathematics and Statistics [Labs.] Stanford U., Calif.
THE RECURRENCE OF REAL MARKOV PROCESSES, by John Lamperti. Technical rept. no. 27on Contract Nonr-225(21). 8 June 59, 23p. 5 refs. AD-217 647.
Order from LC mi$2.70, ph$4.80 PB 147 895

Markov processes are considered which have the nonnegative reals as their state space, and the property that the transitions made by the process are uniformly bounded. If $\{X_n\}$ are the random variables comprising the process, then for some constant $M<\infty$, $|X_{n+1} - X_n| \leq M$ a. s., $n = 0, 1, 2, \ldots$. Conditions are found under which $X_n \to \infty$ a. s. ($\{X_n\}$ is transient), and also under which $\{X_n\}$ is recurrent. These conditions are in terms of the behavior of the function $F(x, y) = \Pr(X_{n+1} \leq y \mid X_n = x)$ for large values of x. (Author)

California U., Los Angeles.
INCREMENTAL PHASE PLANE ANALYSIS OF NONLINEAR SECOND ORDER DIFFERENCE EQUATIONS, by Richard A. Nesbit. Rept. on Contract AF 49(638)438. Feb 60, 36p. 13 refs. Dept. of Engineering rept. no. 60-28; AFOSR-TN-60-616.
Order from LC mi$3.00, ph$6.30 PB 150 251

The use of the incremental phase plane in the analysis of nonlinear difference equations is discussed. The variable and its first difference are the coordinates of this plane; for each point in the plane there is a unique solution to a second order difference equation. The relation between the trajectories in the incremental phase plane and in the ordinary phase plane is shown for linear paired equations. An isocline method of graphically obtaining the solution to the difference equation is developed. An extension of the isocline method gives a set of curves tangent to the solution path, called path tangent curves. These curves allow convenient description of difference equation switching. Criteria for the determination of the stability of singular points in the incremental phase plane are given for both forms of the difference equation. For continuity of development, a synopsis of related material is presented. It is intended that these techniques may be applied to aid the design of nonlinear sample data systems. (Author)

California U., Berkeley.
LOWER BOUNDS FOR THE FIRST EIGENVALUE OF ELLIPTIC EQUATIONS OF ORDERS TWO AND FOUR by William W. Hooker. Technical rept. no. 10 on Contract AF 49(638)398. Aug 60, 51p. 24 refs. AFOSR-TN-60-806.
Order from LC mi$3.60, ph$9.30 PB 150 237

This dissertation is concerned with the analytic and numerical study of a new method of obtaining lower bounds for the first eigenvalue of elliptic differential equations. The basic feature of this method was developed by M. H. Protter from an idea due originally to Picard.

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
LINEAR PROGRAMMING AND DISCRETE DYNAMIC PROBLEMS, by John F. Muth. ONR memo. no. 67 on Planning and Control of Industrial Operations, Contract [Nonr-760(01)] Oct 59, 11p. 2 refs. AD-227 319.
Order from LC mi$2.40, ph$3.30 PB 149 878

A system is assumed to possess a finite number of states, the probability of being in any particular one depending on the previous state of the system, as well as the process chosen by the decision-maker. The probabilities and the short-run profits for each transition and process constitute the data. The problem is to find the policies leading to maximum profits in the long run. The purpose of this paper is to show that the problem may be handled with extreme point methods of linear programming. By recasting the problem in such terms a variety of efficient algorithms and computing routines are available for practical use.

Carnegie Inst. of Tech. Graduate School of Industrial Administration, Pittsburgh, Pa.
OPTIMAL PROCESS MEANS AND THE DISTRIBUTION OF COMPLETION TIMES, by John F Muth. ONR Research memo. no. 66 on The Planning and Control of Industrial Operations, Contract [Nonr-760(01)]. Sep 59, 18p. 4 refs. AD-227 318.
Order from LC mi$2.40, ph$3.30 PB 148 603

Quality control theory is concerned with accepting a batch of a product or detecting when a production process starts to wander or get out of control with

minimal sampling costs for a specified degree of precision. Problems on the optimal design of the process are examined. One of these is choosing the mean of a process to minimize the costs of scrapping and reworking an item. The problem is stated as follows: suppose a single dimension of a part is being machined; for a unit to be acceptable, this dimension must lie between the lower tolerance limit, L, and the upper limit, U. If the relevant dimension is less than L, the item must be scrapped and replaced at an extra cost of S; if greater than U, it may be reworked at an extra cost of R. (Author)

Chicago U., Ill.
NOTE ON COHOMOLOGY ALGEBRAS OF SYMMETRIC GROUPS, by Minoru Nakaoka. Technical note on Contract AF 18(600)1383. June 60, 19p. 5 refs. AFOSR-TN-60-757.
Order from LC mi$2.40, ph$3.30 PB 150 059

This is a continuation of a previous paper, and deals with the mod p cohomology algebra $H^*(S(m); Z_p)$ of the symmetric group S(m) of degree m, where $1 \leq m \leq \infty$ and p is a prime.

[Colorado U., Boulder]
INFINITE RADICALS IN THE COMPLEX PLANE, by Georgellen Schuske and W. J. Thron. Rept. on Contract AF 49(638)100. [1960] 11p. 8 refs. AFOSR-TN-60-909.
Order from LC mi$2.40, ph$3.30 PB 150 195

The purpose of this paper is to determine conditional convergence regions for sequences $\{u_n\}$ with complex elements. The Stieltjes-Vitali Theorem for normal families of functions is used, together with Herschfeld's criterion for infinite radicals with positive real elements. This method is similar to that used previously in the case of continued fractions.

Columbia U., New York.
ON SOME NON-ORTHOGONAL FACTORIAL DESIGNS, by Gideon Schwarz. Rept. on Contract Nonr-266(59). June 59, 21p. 3 refs. CU-6-59-Nonr-266(59)MS; AD-217 622.
Order from LC mi$2.70, ph$4.80 PB 147 892

A class of multifactorial designs are defined and analyzed. The designs considered have each a total number of observations that can not be divided equally among the cells of the designs. By distributing the observations in a way that is in a certain sense symmetrical, the equations that determine the least squares estimates of the parameters become explicitly solvable. The case of 2 non-interacting factors with arbitrary numbers of levels is treated. In the n-factor case, factors having equal numbers of levels are considered. After defining the designs, the estimates and their variances and covariances are computed. Some general discussions are included of the symmetries and algebraic properties involved. (Author)

Columbia U. School of Engineering, New York.
SURVEILLANCE SAMPLING PLANS WITH RANDOM TIMES OF INSPECTION, by P. Frank. Technical rept. no. 4 on Contract Nonr-266(55). 10 June 59, 12p. 4 refs. AD-217 623.
Order from LC mi$2.40, ph$3.30 PB 147 894

An analysis is presented of a situation whereby the times of inspection are not fixed in advance, but are chance quantities with continuous distributions. The principal effect is to make the proportion defective a continuous function of time which approaches a constant after a long time has elapsed. The procedure is considered as an approximation to the fixed surveillance sampling plans. The principal mathematical tool is the renewal theory. Age in a renewal process has a stationary distribtuion depending on the replacement policy. The steady state proportion defective becomes a definite integral instead of the infinite sum, which are evaluated in special cases. Consideration is also given to replacement policies which lead to exponential holding times. These results lead to a simple evaluation of speeding up inspection.

Diamond Ordnance Fuze Labs., Washington, D. C.
A GENERAL THEORY FOR ASYMMETRICAL CONFOUNDED, FACTORIAL EXPERIMENTS, by Badrig Kurkjian. Doctoral thesis. 21 Apr 60, 96p. 24 refs. Technical rept. TR-829.
Order from LC mi$5.40, ph$15.30 PB 150 019

A general theory is developed for the analysis of factorial experiments involving an arbitrary number of factors each at an arbitrary number of levels. The general case is treated where the treatment-combinations are assigned to an appropriate incomplete block design. New results are given for obtaining the best linear estimates (and the associated var-cov matrix) of the various main effect and interaction terms. A large class of partially balanced incomplete block (PBIB) designs with an arbitrary number of associate classes is described which can be treated by the methods of this paper. The theory is applied to two PBIB designs with three associate classes. (Auchor)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
A FABER-KRAHN INEQUALITY FOR WEDGE-LIKE MEMBRANES, by L. E. Payne and H. F. Weinberger. Rept. on Contract AF 49(638)288. Mar 60, 17p. 12 refs. Technical note BN-202; AFOSR-TN-60-416; AD-235 626.
Order from LC mi$2.40, ph$3.30 PB 148 997

Among all membranes lying in a wedge $0 \leq \Theta \leq \pi/\alpha$, $\alpha \geq 1$ and having given value of $\iint r^{2\alpha} \sin^2 \alpha\Theta r\, dr\, d\Theta$, the circular sector of angle π/α is shown to have the lowest fundamental mode. This leads to lower bounds for the fundamental frequency of any membrane, (Author)

Institute of Mathematical Sciences, New York U., N. Y.
ASYMPTOTIC SOLUTION OF SYSTEMS OF LINEAR ORDINARY DIFFERENTIAL EQUATIONS WITH DISCONTINUOUS COEFFICIENTS, by Clive R. Chester and Joseph B. Keller, Rept. on Contract AF 19(604)5238. Dec 59, 20p. 2 refs. Research rept. no. EM-150; AFCRC-TN-60-111; AD-233 308.
Order from LC mi$2.40, ph$3.30 PB 148 988

A system of linear first order ordinary differential equations is considered in which the coefficient matrix depends upon a parameter k. The asymptotic

form of the solutions of this system are determined for large values of k when the coefficient matrix or some of its derivatives have finite jump discontinuities. The asymptotic form contains terms beyond those previously known. These new terms have discontinuous coefficients, whereas the previously known terms are continuous. The results are applied to the one dimensional propagation of time-harmonic waves.

Institute of Mathematical Sciences, New York U., N. Y.
AN ISOSPECTRAL FAMILY OF RANDOM PROCESSES, by R. A. Silverman. Rept. on Contract AF 19(604)5238. Jan 60, 19p. 7 refs. Research rept. no. EM-151; AFCRC-TN-60-129; AD-233 309.
Order from LC mi$2.40, ph$3.30 PB 148 989

A family of random step functions $\{x_n(t)\}$ is constructed whose members all have the same power spectrum and such that as $n \to \infty$, $x_n(t)$ converges to $x_\infty(t)$, the Gaussian process with the same spectrum. The procedure for calculating the general multivariate distribution of the processes $\{x_n(t)\}$ is illustrated by calculating the univariate, bivariate and trivariate distributions. Also shown is how a suitably constructed univariate entropy can serve as an index of the extent to which $x_n(t)$ has approached the Gaussian limit $x_\infty(t)$. (Author)

Institute of Statistics, U. of North Carolina, Chapel Hill.
ON SUFFICIENCY AND INVARIANCE WITH APPLICATIONS IN SEQUENTIAL ANALYSIS, by William Jackson Hall. Rept. on Contract AF 49(638)261. June 59, 22p. 18 refs. Mimeograph Series no. 228; [AFOSR] TN-59-794; AD-235 091.
Order from LC mi$2.70, ph$4.80 PB 148 239

Contents:
Invariantly sufficient statistics
Application to sequential tests of composite hypotheses
A two-sided sequential t-test
Invariance and subfields

Israel Inst. of Applied Social Research.
A CONSTRUCTIVE FORMULA FOR COMMUNALITIES by Louis Guttman. Technical note no. 4 on Contract AF 61(502)121. Feb 60, 37p. 14 refs. AFOSR-TN-60-1006.
Order from LC mi$3.00, ph$6.30 PB 150 360

Let R be a Gramian matrix of order n. The communality problem of factor analysis is to find a real diagonal matrix U such that $R - U^2$ satisfies two conditions. One condition is that $R - U^2$ be Gramian; a second condition is that U be optimal in some sense. A rather general formula is provided for constructing matrices U for which $R - U^2$ is always Gramian. Given the class of matrices so constructed, one can then go on to impose an optimality condition and yet be assured that the Gramian condition is also maintained.

Kansas U., Lawrence.
PROJECTIONS ONTO SOME FUNCTION SPACES, by B. Grünbaum. Technical rept. no. 23 on Studies in Eigenvalue Problems, Contract Nonr-58304. 1959, 15p. 10 refs. AD-227 298.
Order from LC mi$2.40, ph$3.30 PB 149 941

Estimates are considered for norms of projections onto subspaces (of a special kind) of the Banach spaces of all bounded functions defined on infinite sets. The results obtained generalize those of Sobczyk [Bull. Am. Math. Soc. 47:938-947, 1941] and McWilliams [Notices Am. Math. Soc. 5:838, 1958] that any separable Banach space containing (c_0) [resp. (c)] as a subspace may be projected onto (c_0) [resp. (c)] by a projection P with $\|P\| \leq 2$ [resp. $\|P\| \leq 3$]. For a (real, or complex) Banach space X and a (finite, or infinite) cardinal, k, the projection constant $P_X(X)$ is defined as follows: $P_X(X)$ is the greatest lower bound of reals p which have the property: If Y is a Banach space, if $X \subset Y$, and if the quotient-space Y/X contains a dense set of cardinality less than or equal to k, then there exists a projection P of Y onto X such that $\|P\| \leq p$. If $P_k(X)$ is not only the greatest lower bound but the minimum of the numbers p, the projection constant is called exact. (Author)

Liège U. (Belgium).
A TAUBERIAN THEOREM, by F. J. Bureau. Technical scientific note no. 3 on Contract AF 61(052)86. Mar 60, 39p. 9 refs. AFOSR-TN-60-392.
Order from LC mi$3.00, ph$6.30 PB 150 040

Maryland U., College Park.
ON A THEOREM OF CALDERÓN AND ZYGMUNG ON THE FOURIER INVERSION IN E^n AND TWO FOURIER TRANSFORMS, by David A. Sprecher. Rept. on Contract AF 49(638)590. July 60, 12p. 8 refs. AFOSR-TN-60-870; AD-242 311.
Order from LC mi$2.40, ph$3.30 PB 150 272

Two Fourier integrals, evaluated hitherto by using the Fourier Inversion Theorem, are evaluated directly by elementary means. In the second part of the paper, a theorem of Calderón and Zygmund on the Fourier inversion in Euclidean space, E^n, is generalized and extended to Euclidean spaces of arbitrary dimensions. (Author)

Missouri U. [Columbia]
PROPERTIES OF THE SOLUTIONS OF $u''+g(t)u^{2n-1}=0$ by W. R. Utz. Rept. on Contract AF 49(638)754. July 60, 11p. 5 refs. AFOSR-TN-60-810.
Order from LC mi$2.40, ph$3.30 PB 150 194

Naval Civil Engineering Lab., Port Hueneme, Calif.
COMPILATION OF EXPONENTIAL FUNCTIONS FOR ARGUMENTS FROM .2 THROUGH 50, by J. C. LeDoux and L. K. Donovan. Final rept. 25 July 60, 103p. 3 refs. Technical Compilation C-003.
Order from LC mi$5.70, ph$16.80 PB 150 889

Expressing mathematically the attenuation of nuclear radiation through various materials requires exponential functions. This compilation provides functions e^{-x}, e^{-x}/x, and $E_1(x)$ for arguments from 2.00 to 50.99 with a maximum error of $\pm$ 3 in the sixth significant figure. (Author).

Naval Weapons Lab., Dahlgren, Va.
INTEGRATION OF THE GENERAL BIVARIATE GAUSSIAN DISTRIBUTION OVER AN OFFSET ELLIPSE, by A. R. DiDonato and M. P. Jarnigan. 11 Aug 60, 68p. 7 refs. NWL rept. no. 1710.
Order from LC mi$3.90, ph$10.80 PB 150 275

This paper describes an efficient method for the numerical evaluation by a high-speed digital computer of the integral of any correlated or uncorrelated elliptical Gaussian distribution over the area of any arbitrarily centered and oriented ellipse in the plane. The NORC program will yield results correct to three or six decimal digits, as selected with an average computing time of 0.1 and 0.2 of a second, respectively. A useful table (10,080 entries) is included. (Author)

North Carolina U., Chapel Hill.
A NON-PARAMETRIC COMPARISON OF TWO SAMPLES ONE OF WHICH IS CENSORED, by John G. Saw. Technical rept. no. 12 on Estimation and Testing of Parameters by Order Statistics, Contract DA 36-034-ORD-2184. 1 June 60, 27p. 4 refs. OOR rept. no. 1597.16; AD-240 054.
Order from LC mi$2.70, ph$4.80 PB 150 395

Suppose x and y are random variables with continuous cumulative distribution functions F(x) and G(y). A null hypothesis of the form H_0: F = G is tested. Standard parametric and non-parametric tests are well established when a complete sample is taken from both populations. The assumption is made that a complete sample $x_1, x_2, \ldots, x_n$ is taken from F(x), but that of a sample of size m, taken from G(y), the smallest (r-1) and the largest (m-s) observations are not available for statistical purposes. The properties are investigated of a statistic T, defined (as for the Mann-Whitney U-statistic for complete samples) to be the total number of times an x-observation is less in magnitude than a y-observation. The distribution of T, its consistency against alternatives of the form H_1: F$\neq$G and its asymptotic power, relative to U are also considered. (Author)

North Carolina U., Chapel Hill.
A NOTE ON THE ERROR AFTER A NUMBER OF TERMS OF THE DAVID AND JOHNSON SERIES FOR THE EXPECTED VALUE OF THE r-TH SMALLEST OF n ORDERED NORMAL VARIATES, by John G. Saw. Technical rept. no. 13 on Estimation and Testing of Parameters by Order Statistics, Contract DA 36-034-ORD-2184. 15 July 60, 18p. 4 refs. OOR rept. no. 1597.17-M; AD-240 427.
Order from LC mi$2.40, ph$3.30 PB 150 410

Bounds are derived for the error which results in using only a finite number of terms of the David and Johnson series (Biometrica 41:228-40, 1954). The method of Plackett (Ann. Math. Statist. 29:131-42, 1954) and the method of David and Johnson are compared by applying these techniques in a particular case. The convergence of the Plackett series is found to be faster than the David and Johnson series, and the bounds which Plackett gives are found to be sharper than those which are derived for the David and Johnson series. These slight differences are negligible in the light of the computational advantages to the David and Johnson technique over that of Plackett.

Princeton U., N. J.
ANALYTIC SPACES, PART II, by Hugo Rossi. rept. on Contract AF 49(638)692. July 60, 111p. 8 refs. AFOSR-TR-60-100.
Order from LC mi$6.00, ph$18.30 PB 150 048

Contents:
Removable singularities
Analytic covers and ringed spaces
The normalization theorem
Local uniform convergence

Rensselaer Polytechnic Inst., Troy, N. Y.
THE CONSTRAINED GRADIENT METHOD OF LINEAR PROGRAMMING, by C. E. Lemke. Rept. on Contract Nonr-591(13). 1 Oct 59, 32p. 12 refs. RPI MathRep. no. 27; AD-228 403.
Order from LC mi$3.00, ph$6.30 PB 149 857

An efficient algorithm is presented for solving the general linear programming problem whereby, from a point on the boundary of the feasible point set, the steepest or constrained gradient direction from the point is found. Moving as far in this direction as feasibility permits, the next feasible point is obtained etc. The process ends in a finite number of such steps. (Author)

Rensselaer Polytechnic Inst., Troy, N. Y.
PERIODIC RESPONSES AND SUPERPOSITION IN A NONLINEAR CONTROL SYSTEM, by B. A. Fleishman. Rept. on Contract AF 49(638)514. 19 May 60, 24p. 4 refs. RPI MathRep. no. 34; AFOSR-TN-60-477.
Order from LC mi$2.70, ph$4.80 PB 150 262

A simple relay servomechanism (or on-off control system) is subjected to arbitrary periodic input signals, and various periodic responses are studied. Two types of results are obtained. First of all, exact analytical expressions for periodic responses, of harmonic and subharmonic type, and derived in a formal manner, and conditions are established for their validity. Secondly, it is shown that for certain classes of periodic inputs various superposition properties hold; in particular, that the average of the periodic responses to a set of inputs is just the response to the average input. It is thus seen that on-off control systems may display both nonlinear features (subharmonic oscillations) and linear features. (superposition). (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
AN INTRODUCTION TO PROBABILITY THEORY: CONTINUOUS SCHEMES, by F. M. Reza. July 60, 97p. 8 refs. RADC-TN-60-67.
Order from LC mi$5.40, ph$15.30 PB 150 241

This report, an extension of RADC-TN-59-129 (PB 144 485), is a survey of the modern theory of probability where the random variable is allowed to assume a continuum of values. With particular attention to those aspects of theory of interest to the Electrical Engineer. The density and distribution function are introduced, and several common distribution functions are discussed. The concept of expected value is introduced and extends to the expectation of finite sums and products of independent random variables. Bivariate and multivariate random variables and linear combinations are discussed. (Author)

Statistical Techniques Research Group, Princeton U., N. J.
AUTOMATIC OPTIMIZATION OF CONTINUOUS PROCESSES, by J. Chanmugam and G. E. P. Box. Technical rept. no. 38 on Contract DA 36-034-ORD-2297. July 60, 78p. 10 refs. [OOR rept. 1715:35]
Order from LC mi$4.50, ph$12.30 PB 150 404

Contents:
Introduction: the process function; conventional control for optimization; evolutionary operation
Basis for automatic optimization of continuous processes: discrete and continuous changes of process variables, no dynamic effects; effect of noise; continuous changes of process variables with dynamic effects
A simple reaction system
Extension of theoretical model: multicomponent first order sequential reactions; analysis in terms of phase shifted components; analysis when order of reactions in multicomponent system are not necessarily unity; optimizing with respect to temperature
Notes on design of self optimizing reactor
Analysis of multicomponent first order sequential reaction system
Analysis of multicomponent reaction sequence with kinetics not necessarily first order

Washington U., Seattle.
INTEGRATION OF SUBSPACES DERIVED FROM A LINEAR TRANSFORMATION FIELD, by Edward T. Kobayashi. Technical rept. no. 8 on Contract Nonr-477(15). 30 June 59, 35p. 8 refs. AD-220 536.
Order from LC mi$3.00, ph$6.30 PB 147 890

The integrability is investigated of the distribution of Θ of vector subspaces Θ_p of the tangent spaces T_p to a manifold M, $p \in M$, when Θ_p is intrinsically related to a given field h on M, of linear transformations h_p on T_p. (Author)

Wayne State U., Detroit, Mich.
AN AXIOMATIC APPROACH TO HOMOTOPY THEORY WITHOUT USING THE RELATIVE GROUPS, by Sze-Tsen Hu. Technical note no. 9 on Contract AF 49(638)179. June 60, 12p. 3 refs. AFOSR-TN-60-641.
Order from LC mi$2.40, ph$3.30 PB 150 058

The existing axiomatic approach to homotopy theory is formulated in terms of the relative homotopy groups, the boundary homomorphisms, and the induced homomorphisms. In the present note, an axiomatic approach is introduced without using the relative homotopy groups. (Author)

Computing Devices

Michigan U., Ann Arbor.
COMPUTATION, BEHAVIOR, AND STRUCTURE IN FIXED AND GROWING AUTOMATA, by Arthur W. Burks. Technical rept. on Contract Nonr-1224(21). Oct 59, 40p. 48 refs. AD-227 665.
Order from LC mi$3.00, ph$6.30 PB 149 486

Contents:
Structure, behavior, and computation in fixed automata and generalized Turing machines
Analysis and synthesis of automata
Growing automata
Some problems with growing automata

Michigan U. [Research Inst.] Ann Arbor.
SPINNING DISK RANDOM SELECTORS, by G. A. Roberts. Technical memo. no. 39 on Contract DA 36-039-sc-63203. Apr 57, 35p. 2262-151-T; AD-155 366.
Order from LC mi$3.00, ph$6.30 PB 149 364

A three decade spinning disk electronic random selector or number generator is described. The number selections are equally likely and the modulus is adjustable from 10 to 1000 in increments of 10. (Author)

Remington Rand Univac Div., Sperry Rand Corp., Philadelphia, Pa.
THE PREPARATION AND CHARACTERISTICS OF THIN FERROMAGNETIC FILMS. Scientific rept. no. 1, 1 Jan 59-1 Feb 60, on Contract AF 19(604)4978, continuation of Contract AF 19(604)2659. May 60, 39p. 8 refs. AFCRC-TN-60-572.
Order from LC mi$3.00, ph$6.30 PB 150 211

The results are given of an experimental study of the magnetic properties of thin films prepared by chemical methods. Electro-deposition in aqueous solutions and thermal decomposition of carbonyl vapors have shown very encouraging results. Electrodeposited ferromagnetic nickel-iron films having thicknesses in the range 2500 to 3000 Å give reproducible results when a glass substrate is used onto which a conductive layer of gold is sputtered. Films deposited on Mylar having a conductive layer of evaporated chromium and copper also give good magnetic properties. Such films exhibit an average coercive force of about 1.2 oersteds and H_k on 3 to 5 oersteds depending on their composition. Switching constants of 0.05 to 0.20 oersted-microsecond are obtained by application of crossfields of about 0.25 H_k. Films produced by thermal decomposition of carbonyl mixtures do not as yet show comparable magnetic or switching properties. Control of this process is quite difficult, but fairly reproducible results can be obtained by depositing the films on glass substrates and subsequently annealing them in a hydrogen atmosphere. The average values of coercive force obtained after annealing for films of about 3000 Å are 2.5 oersteds. (Author)

Sibley School of Mechanical Engineering, Cornell U. Ithaca, N. Y.
SOME PROBLEMS OF DIGITAL SYSTEMS SIMULATION, by R. W. Conway, B. M. Johnson and W. L. Maxwell. Rept. on Contract Nonr-401(32). [1959] 40p. 12 refs.
Order from LC mi$3.00, ph$6.30 PB 148 791

This paper consists of three sections. The first is an attempt to describe characteristics common to many system simulations; the second is a discussion of some problems involved in the construction of a digital simulator; and the third concerns problems that arise in the use of such a simulator.

Washington U., Seattle. Div. of Counseling and Testing Services.
A PERCENTILE PROGRAM WITH RELOADABLE OUTPUT FOR THE IBM TYPE 650, by August Dvorak and George R. Burket. Rept. on Contract Nonr-477(08) and Public Health Research Grant M-744(04). Nov 59, 7p. 2 refs. AD-237 251.
Order from LC mi$1.80, ph$1.80 PB 147 773

A modified version is given of a previously reported percentile program by Dvorak & Burket [An IBM Type 650 program to calculate percentile scores, ONR T.R., July 1959]. The program permits adding or subtracting previous output tallies from tallies already on the drum. The load hub feature is used for this purpose so that no additional read wiring is required. Through the use of control cards, it is possible to perform the following operations as many times as desired and in any sequence: (a) clear accumulation areas, (b) read and tally case cards, (c) add previous output tallies, (d) subtract previous output tallies, and (e) punch tallies currently on drum, along with individual percents and percentile values. (Author)

MECHANICS

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
SNAPPING OF SHALLOW SPHERICAL SHELLS UNDER STATIC AND DYNAMIC LOADINGS, by Jiro Suhara. Rept. on Contract AF 49(638)160. June 60, 77p. 15 refs. AFOSR-TN-60-831; ASRL TR-76-4.
Order from LC mi$4.50, ph$12.30 PB 150 245

A study of finite deformations of clamped shallow spherical shells subjected to static and dynamic loadings is presented in this report. The solutions of the static problem are obtained by means of both the variational method and the method of expansion in the series of combined Legendre's polynomials. The results are compared with those obtained by Keller and Reiss. Fairly good agreements of both results are obtained for unbuckled branch in the static cases. Dynamic behavior of shallow spherical shells which undergo suddenly applied uniform pressure of infinite duration are investigated using two different methods. In the first a simple trial function for the deformation mode is assumed and the dynamic equation is obtained by variational method; the equation is then solved by means of an electronic analogue computer. Other trials are made to estimate the dynamic maximum deformations due to a given dynamic load. Principle of conservation of energy is used in this case. The analyses involve two sets of solutions. In the first a simple trial function is used while in the other the Legendre's polynomials solutions that were obtained previously for the static problem are used. Estimations of the dynamic snapping loads are given for shells of two kinds of shallowness. (Author)

Brown U. Div. of Engineering, Providence, R. I.
STUDY OF FRACTURE STRENGTHS OF SINTERED CARBIDES, by D. E. Gucer and J. Gurland. Final rept on Contract DA 19-020-ORD-4888. June 60, 10p. DA-4888/5; OOR rept. 2060.5-Met.
Order from LC mi$1.80, ph$1.80 PB 150 399

A summary of the four technical reports prepared on this contract. (See also PB 150 398)

Fritz Engineering Lab., Lehigh U., Bethlehem, Pa.
RESTRAINED COLUMNS, by Morris Ojalvo. Progress rept. no. 38 on Welded Continuous Frames and Their Components, Contract Nonr-610(03). Sep 59, 17p. 12 refs. Fritz Engineering Lab. Rept. no. 278.2; AD-228 395.
Order from LC mi$2.40, ph$3.30 PB 148 605

A method for determining the carrying capacity of restrained columns of constant cross section is described. The type of column failure considered is that due to bending about one of the principal axes of the cross section. The plane of bending is also the plane of the thrust, applied moments and the restraining moments. The method is applicable when the loads are applied to the columns with equal or unequal end eccentricities and can be used for cases where the restraining moments are not linear functions of the end rotations of the column. It also takes into account the inelastic action of the column and thus leads to a solution of the true ultimate carrying capacity of such members. It is shown how convenient nomographs may be developed for columns with one end hinged and for columns with equal applied end moments and with equal rotational restraints at the ends. The availability of nomographs for the latter two cases reduces the effort involved in designing restrained columns to a point where it would be appropriate for design office use. (Author)

Illinois Inst. of Tech., Chicago.
PLASTIC INTERACTION CURVES FOR ANNULAR PLATES IN TENSION AND BENDING, by Philip G. Hodge, Jr. and R. Sankaranarayanan. Rept. on Contract Nonr-140604. Oct 59, 21p. 5 refs. DOMIIT rept. no. 1-9.
Order from LC mi$2.70, ph$4.80 PB 149 513

An annular plate made of a perfectly plastic material is subjected to a uniform normal load P over its surface and a constant tensile load T around its outer edge. Close bounds on the interaction curve are found for all values of the inner radius under various support conditions at the inner edge. (Author)

Institute for Fluid Dynamics and Applied Mathematics, Maryland U., College Park.
ON THE CONTINUATION OF SOLUTIONS FOR THE EQUATIONS OF ELASTICITY BY REFLECTION, by J. H. Bramble and L. E. Payne. Rept. on Contract AF 49(638)228. Aug 60, 10p. 5 refs. Technical note BN-217; AFOSR-TN-60-903.
Order from LC mi$1.80, ph$1.80 PB 150 037

It is shown that solutions of the equations of elasticity may be continued by reflection across a spherical boundary whenever an arbitrary linear combination of the normal displacement and normal surface traction and an arbitrary linear combination of tangential displacements and tangential surface tractions vanish on the spherical surface. (Author)

Institute of Flight Structures, Columbia U., New York.
EXCITATION OF DISTRIBUTED SYSTEMS, by H. H. Bleich. Technical rept. no. 23 on Contract Nonr-266(08) and Technical rept. no. 1 on Contract Nonr-266(67). Oct 59, 15p. CU-2-59-ONR-266(08)-CE; CU-1-59-ONR(67)-CE.
Order from LC mi$2.40, ph$3.30 PB 149 488

A vibration analysis of very complex distributed systems by exact methods is usually impracticable, and numerical methods using the large computers now available are indicated. The use of numerical methods is roughly equivalent to using a lumped system, but in problems of acoustical fatigue the relatively high frequencies involved may require a rather large number of masses. The purpose of the presentation is a discussion of the appropriate number of masses (or subdivisions of the structure) necessary to obtain a sufficient approximation of the structural response. The matter will be considered for longitudinal and bending vibrations (including shear effects) of linear elastic and viscoelastic members.

Lockheed Aircraft Corp., Sunnyvale, Calif.
INFLUENCE COEFFICIENTS FOR SPHERICAL SHELLS, by B. R. Baker and G. B. Cline, Jr. Technical note on Contract NOrd-17017. June 60, 45p. 12 refs. LMSD-480 817.
Order from LC mi$3.30, ph$7.80 PB 149 969

The differential equations governing the symmetric bending of spherical shells of constant thickness subjected to edge loads are transformed into a form suitable for asymptotic integration. The asymptotic solutions, although obtained in a slightly different manner, are those given previously. These solutions are used to obtain expressions for the influence coefficients of both a spherical cap and the complementary portion of the sphere. The influence coefficients are valid for either shallow or nonshallow spherical shells provided the shells are sufficiently thin. The coefficients are tabulated and the nature of the tables discussed. (Author)

Minnesota U., Minneapolis.
STEADY STATE RESPONSE OF BEAMS WITH TRANSLATIONAL AND ROTATIONAL DAMPING MOTIONS AT THE SUPPORTS, by C. C. Fu and T. J. Mentel. Rept. for Jan-Nov 59 on Materials Analysis and Evaluation Techniques, Contract A AF 33(616)5426. May 60, 52p. 8 refs. WADD Technical rept. 60-60.
Order from OTS $1.50 PB 161 957

Two methods of analysis are presented for the steady state response of beams with translational and rotational damping motions at the supports. The first of these methods uses a continuous model and the second uses a discrete (three-degree-of-freedom) model. Both cases are characterized by non-linear equations and approximate solutions are produced for each. Numerical results are presented giving comparisons and optimum damping configurations. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
A NOTE ON THE IMPACT PRESSURE LOADING OF A RIGID PLASTIC SPHERICAL SHELL, by R. Sankaranarayanan. Rept. on Contract AF 49(638)302. May 60, 12p. 2 refs. PIBAL rept. no. 564; AFOSR-TN-60-639.
Order from LC mi$2.40, ph$3.30 PB 149 164

The behavior of a rigid perfectly-plastic, complete spherical shell under impulsive loading by a uniform radial pressure is discussed. The ensuing radial displacement of the shell is obtained as a function of the load and is presented graphically. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
VIBRATIONS OF ELASTIC SANDWICH CYLINDRICAL SHELLS, by Yi-Yuan Yu. Technical note no. 7 on Contract AF 49(638)453. Jan 60, 33p. 7 refs. AFOSR TN-60-324; AD-235 026.
Order from LC mi$3.00, ph$6.30 PB 149 662

Previous treatment of vibration of elastic sandwich plates is extended to the vibration study of sandwich cylindrical shells. General theory is developed. Simplified equations are applied to the investigation of axially symmetric and torsional vibrations. (Author)

University Coll., Cork (Eire).
ELASTIC BEAM THEORY FOR THE ELECTRONIC COMPUTER: A RECURRENCE APPROACH, by Patrick M. Quinlan. Technical note no. 9 on Contract AF 61(514)1163. June 60, 42p. 11 refs. AFOSR-TN-60-936.
Order from LC mi$3.30, ph$7.80 PB 150 350

A new comprehensive approach to elastic beam theory is presented based on the use of generalized step functions. The paper is divided into two parts, the first dealing with uniform beams and the second with non-uniform beams. Uniform beam on continuous supports, whether rigid or elastic, is solved using a new formulation of the three-moment equation in conjunction with a shear-recurrence formula - called the three-supports equation. An alternative solution for continuous uniform beams on elastic supports is given using generalized step-functions. Part two, dealing with non-uniform

beams, is based entirely on recurrence formulae obtained from generalized step-function approximations to the deflection and slope equations by differencing. Solutions are obtained for all loading conditions, including concentrated moments and end thrust, or end tension. In all cases the solution is reduced to a number of simultaneous equations and is especially geared to the coming decade, when the solution of such equations on the electronic computer should be regular office routine. (Author)

Watervliet Arsenal, N. Y.
INVESTIGATION OF THE BUCKLING AND LARGE DEFLECTIONS OF A SPHERICAL SHELL UNDER THE INFLUENCE OF TORQUES APPLIED AT ITS POLES. PART III. DETERMINATION OF THE CRITICAL TORQUE INDUCING BUCKLING IN A TWISTED SPHERICAL SHELL SUBJECT TO INTERNAL OR EXTERNAL PRESSURE, by C. C. Mow and M. A. Sadowsky. May 60, 39p. Technical rept. WVTRR-6009.
Order from LC mi$3.00, ph$6.30 PB 147 308

The problem of determining the critical value of the torque T inducing buckling in a pressurized twisted spherical shell has been solved under assumption of local non-analytic buckling. The critical relation between the values of the torque T and pressure p has been explicitly determined. (Author)

Aerodynamics and Pneumatics

Aeroelastic and Structures Research Lab., Mass. Inst. of Tech., Cambridge.
PROCEDURES FOR INCLUDING TEMPERATURE EFFECTS IN STRUCTURAL ANALYSES OF ELASTIC WINGS. PART II. A DIGITAL COMPUTER SOLUTION FOR THE EQUIVALENT PLATE METHOD OF THERMOELASTIC ANALYSIS, by Lucien A. Schmidt and Hans A. Balmer. Rept. on Contract AF 33(616)3517. May 59, 173p. 7 refs. WADC Technical rept. 57-754, Pt. II; AD-230 981.
Order from LC mi$8.10, ph$27.30 PB 149 624

A general procedure, employing the IBM 704 EDPM, based on the equivalent plate method of structural analysis for elevated temperature structures previously presented [PB 131 989] has been developed. The program provides a rational method for analyzing the static aeroelastic behavior of thin, low aspect ratio wings subject to elevated temperatures and high wing loadings. The formulation includes coupling between aerodynamic pressures and the thermoelastic distortions, and also coupling between the bending and stretching of the plate. Using the variational principle of Reissner [J. Math. and Phys., 32:1953] and expanding the deflection and the stress function in terms of assumed modes, two coupled nonlinear matrix equations are obtained and solved by successive linearization. The IBM 704 program is used not only to carry out the matrix operations but, of greater importance, to carry out the considerable number of partial differentiations, double integrations, and algebraic operations required to form the matrix elements. Illustrative numerical examples of the use of the generalized digital computer program are given. A discussion of the limitations of the present program as well as suggestions for improvements and extensions conclude the report. (Author)

Arnold Engineering Development Center, Tullahoma, Tenn.
A SUMMARY OF PERFORATED WALL WIND TUNNEL STUDIES AT THE ARNOLD ENGINEERING DEVELOPMENT CENTER, by M. Pindzola and W. L. Chew. Rept. on ARO, Contract AF 40(600)800 S/A 11(60-110). Aug 60, 36p. 21 refs. AEDC TR-60-9.
Order from LC mi$3.00, ph$6.30 PB 150 165

A summary of the work done at AEDC in the development of perforated walls for application to transonic and supersonic wind tunnels is presented. Results are summarized for normal, slanted, and slotted hole walls in the Mach number range from 0.90 to 2.50. The slotted hole data, presented for the first time, indicate that the characteristics of a perforated wall can be determined independently of the free-stream Mach number. (Author).

Avco-Everett Research Lab., Mass.
RELAXATION PROCESSES AND REACTION RATES BEHIND SHOCK FRONTS IN AIR AND COMPONENT GASES, by K. Wray, J. D. Teare and others. Rept. on Contracts AF 04(647)278 and DA 19-020-ORD-4862. Dec 59, 31p. 25 refs. Research rept. 83; AFBMD-TR-60-26; AD-234 034.
Order from LC mi$3.00, ph$6.30 PB 147 829

Non-equilibrium phenomena in normal shocks is summarized. Three classes of experiments are described: (1) absorption of ultra-violet radiation, (2) emission of optical radiation, and (3) microwave absorption and reflection. The use of these measurement techniques in unraveling the complex phenomena that occur in the non-equilibrium region of normal shocks is outlined. The current values used to correlate the experimental data for the chemical and electronic rate constants are quoted. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BALLISTIC RESEARCH LABORATORIES' NEW HYPERSONIC TUNNEL, by J. Sternberg. Jan 60, 22p. 6 refs. BRL rept. no. 1076; AD-237 577.
Order from LC mi$2.70, ph$4.80 PB 148 511

The B.R.L. hypersonic wind tunnel, now under construction, is designed to cover the range M = 5 to 10, and will be capable of continuous flow, variable density operation. Full use will be made of the compressor plant for existing supersonic wind tunnels. Three new centrifugal compressors were added to reach a maximum supply pressure of 2200 psi. The tunnel air will be heated to a maximum temperature of 2000°R, using a combustion heater and an electric heater arranged in series. Some of the complications in hypersonic flight at high altitudes are discussed. Departures from a continuum, low Reynolds number effects, and oxygen dissociation in the atmosphere are all important above 250,000 ft. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
A DIRECT METHOD OF MEASURING DENSITY BEHIND SHOCK WAVES, by D. B. Sleator and M. R. Lewis. Dec 59, 19p. 6 refs. Rept. no. 1087; AD-233 901.
Order from LC mi$2.40, ph$3.30 PB 147 789

A direct method of measuring velocity and density behind a shock wave in a shock tube is described which uses the N-like slip region resulting from the interaction of the shock and a small disturbance. The velocity of the slip region along the axis of the shock tube is shown to be the flow velocity. A description of the interaction of a shock wave and a small disturbance is given. Still and streak schlieren photographs and an interferogram of the phenomenon are presented along with a plot of experimental results versus theory showing an error of about 1 per cent. (Author)

Gas Dynamics Lab., Northwestern U., Evanston, Ill.
DISSOCIATION AND IONIZATION EFFECTS IN THE LAMINAR MIXING OF PARALLEL STREAMS, by Richard Frank Hoglund. Rept. on Contract AF 40(600)748. July 60, 132p. 76 refs. AEDC-TN-60-141.
Order from LC mi$6.90, ph$21.30 PB 149 319

The boundary layer approximation is applied to the equations governing the mixing zone between two parallel semi-infinite streams. The two streams differ in composition and temperature, but they are not necessarily in chemical equilibrium. Closed form solutions are obtained for the approach to equilibrium in the mixing zone in the case of equal velocities of the two streams. Frozen flow and equilibrium flow appear as limiting cases of the general solution. A linearized reaction rate law is used for the non-equilibrium situations. These solutions indicate that the major factor contribution to non-equilibrium effects in the constant velocity mixing zone is the presence of non-equilibrium conditions outside of the mixing zone. An approximate solution to the case of unequal free stream velocities is obtained using an equilibrium condition found to be applicable in the constant velocity. case. The results of these studies are used to provide a qualitative indication of the effects of dissociation and ionization reactions on the flow field immediately behind a hypersonic body. It is found that the presence of reactions in various regions of this flow field causes individual and discernible change in the wake expansion angle and in the base pressure. (Author)

General Atomic, San Diego, Calif.
THE USE OF MODULATED ATOMIC-BEAM TECHNIQUES FOR THE STUDY OF SPACE-FLIGHT PROBLEMS, by Geoffrey S. Holister, R. T. Brackmann, and Wade L. Fite. Rept. on Contract AF 49(638)356. 14 Oct 59, 20p. 4 refs. GA-1024; AFOSR-TN-59-1033; AD-229 282.
Order from LC mi$2.40, ph$3.30 PB 150 065

In order to investigate atom-surface interactions which affect drag on objects flying in atmospheres where the gas is dissociated (e.g., above 100 km), modulated-atomic-beam techniques were used, with both atomic-oxygen and atomic-hydrogen collisions at common laboratory surfaces being studied. Two types of experiments are discussed. In the first, an incident beam impinges on a surface and the particles leaving the surface are examined with a mass spectrometer. By varying the incident beam and/or surface temperature, thermal accommodation coefficients are determined for a variety of surfaces and gases. Using an incident atomic beam, the probability that an atom will rebound from the surface as a free atom is measured; from examination of the reflected molecular signal, information on the probability of reassociation at the surface is obtained. In the second, the atomic beam, which is monitored mass-spectrometrically, is allowed to strike a surface placed on a torsion balance, and momentum transfer is measured directly. In these experiments, the atomic-beam apparatus is used as an atomic wind tunnel; when a hydrogen-atom beam from a furnace source operating at 3000°K is used, the case of a high-altitude satellite is fairly closely duplicated. Results of a number of experiments using these techniques are presented. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
MODIFIED CROCCO-LEES MIXING THEORY FOR SUPERSONIC SEPARATED AND REATTACHING FLOWS, by Herbert S. Glick. Rept. on Hypersonic Research Project, Contract DA 04-495-ORD-1960. 2 May 60, 118p. 34 refs. Memo. no. 53; AD-239 560.
Order from LC mi$6.00, ph$18.30 PB 149 361

Re-examination of the Crocco-Lees method has shown that the previous quantitative disagreement between theory and experiment in the region of flow up to separation was caused primarily by the improper C(K) relation assumed. A new C(K) correlation, based on low-speed theoretical and experimental data and on supersonic experimental results, has been developed and found to be satisfactory for accurate calculation of two-dimensional laminar supersonic flows up to separation. A study of separated and reattaching regions of flow has led to a physical model which incorporates the concept of the "dividing" streamline and the results of experiment. According to this physical model, viscous momentum transport is the essential mechanism in the zone between separation and the beginning of reattachment, while the reattachment process is, on the contrary, an essentially inviscid process. This physical model has been translated into Crocco-Lees language using a semi-empirical approach, and approximate C(K) and F(K) relations have been determined for the separated and reattaching regions. The results of this analysis have been applied to the problem of shock wave-laminar boundary layer interaction, and satisfactory quantitative agreement with experiment has been achieved. (Author)

Guggenheim Aeronautical Lab., Calif. Inst. of Tech., Pasadena.
A SUMMARY OF THE THEORIES AND EXPERIMENTS ON PANEL FLUTTER, by Y. C. B. Fung. Rept. on AGARD Manual on Aero-Elasticity, Contract [AF 49(638)220.] May 60, 81p. 74 refs. AFOSR-TN-60-224.
Order from LC mi$4.80, ph$13.80 PB 149 764

In recent years a sizable literature has grown out of the field of panel flutter. Much effort was spent in resolving several theoretical difficulties which arise one way or another when one tries to simplify the analytical problem by introducing various limiting cases and approximations. These difficulties are now fairly well understood. In the meantime, a considerable amount

of numerical evaluation has been done so that the technical significance of the problem can be better appreciated. The present article gives a review of various theories, and a summary of the panel-thickness requirements for the prevention of flutter under various circumstances. At the present time, available information on supersonic panel flutter is still incomplete. It is hoped that the present article may provide a guide to the existing literature; and, in projecting the known areas in clear relief, may serve to suggest areas for future research. (Author).

Heat Transfer Lab., U. of Minnesota, Minneapolis.
EFFECT OF BUOYANCY FORCES ON MASS TRANSFER COOLING, by R. Eichhorn. Technical rept. no. 25 on Contract AF 18(600)1226. Feb 60, 16p. 3 refs. AFOSR-TN-60-64.
Order from LC mi$2.40, ph$3.30 PB 149 083

Consideration is given to the constant property laminar boundary layer equations with free convection and mass transfer. It is shown that similar solutions are possible for blowing rate distributions varying as the distance from the leading edge raised to the power $\frac{n-1}{4}$ where n is the exponent in a power law surface temperature distribution. Solutions to the equations in the form of skin friction and heat transfer parameters, and velocity and temperature profiles are presented for the constant wall temperature case for a fluid with $Pr = 0.73$. The cases considered range from strong suction to strong blowing. Mass transfer has a pronounced effect on the heat transfer but only a slight effect on the skin friction. In light of the solutions presented these effects are shown to be physically rational. (Author)

Küssner, H. G.
RESEARCH ON THE OSCILLATING ELLIPTIC LIFTING SURFACE IN SUBSONIC FLOW, by H. G. Küssner. Technical final rept. on Contract AF 61(052)215. June 60, 75p. 13 refs. AFOSR-TR-60-71.
Order from LC mi$4.50, ph$12.30 PB 150 333

Starting from the linearized Euler equations an integral representation of the pressure of the oscillating elliptic lifting surface in subsonic flow is given for arbitrary downwash distributions and arbitrary yaw angles. The kernel of this integral representation is contructed by means of the Green function of the elliptic plate oscillating in still air. Two methods of determination of the Green function are given. The first one uses infinite series of products of ellipsoidal surface harmonics and Lamè functions. The second method only holds for incompressible flow but gives results in a closed form. This form has been used in order to solve the integral equation for the weight function of the leading edge singularity of the lifting surface. According to this method the special cases of the elliptic lifting surface with infinite aspect ratio and of the circular lifting surface have been treated. Numerical values of the weight functions and of the aerodynamic derivatives have been calculated for a bilinear downwash distribution. The results of this method have been used to check the accuracy of the current collocation method of the three-dimensional lifting surface theory. (Author)

Maryland U., College Park.
ON CONDUCTING FLOW PAST A MAGNETIZED CIRCULAR CYLINDER, by Lan-Keh Chi. Interim technical rept. no. 46 on Fundamental Research in Applied Mathematics, Contract DA 36-034-ORD-1486. June 60, 46p. 4 refs. OOR rept. no. 407:55; AD-239 906.
Order from LC mi$3.30, ph$7.80 PB 150 396

The flow of a conducting fluid past a magnetized sphere was considered by Ludford and Murray. It is of interest to know what will happen if the finite sphere is replaced by an infinitely long circular cylinder. A steady incompressible and inviscid fluid is considered. Results are obtained first for a two-dimensional magnetic dipole, pointing downstream, at the center of the cylinder and then for a general magnetic distribution inside the cylinder. Only the first-order effects of the weak magnetic field are considered. The discussion is valid for arbitrary conductivity of the cylinder, as long as it is finite. The situation when the magnetic dipole field is frozen into the cylinder is also discussed. A matching between the Stokes and the Oseen small R_m expansions for the flow past the cylinder with a dipole inside is carried out explicitly to a certain number of terms. It is found that a new perturbation series whose leading term is of order $R_m^2 \log R_m$, should be introduced into the Stokes expansion. (Author).

Mississippi State U., State College.
THE APPLICATION OF SUCTION TO A TWO-DIMENSIONAL LAMINAR SEPARATION BUBBLE, by F. M. Burrows and B. G. Newman (U. of Cambridge). Research rept. no. 27 on Contract Nonr-978(01). 1 Oct 59, 67p. 11 refs. AD-228 532.
Order from LC mi$3.90, ph$10.80 PB 149 858

The effect of suction or blowing through a perforated surface in the vicinity of a laminar separation bubble was investigated. The bubble was produced at a sharp corner on one wall of a small wind tunnel and the tests were made at a low Mach number under effectively 2-dimensional conditions. It was found that the size of the bubble and the thickness of the boundary layer downstream were reduced by increasing the suction and were similarly increased by much smaller amounts of blowing. Five different distributions of transpiration were tested and the various parameters describing the turbulent boundary layer downstream of reattachment were found to depend on the total quantity of flow removed and to be very nearly independent of the distribution itself. The measured values of pressure rise in the region of reattachment were roughly in agreement with a simple momentum analysis which includes the effect of transpiration. It is concluded that the application of suction near a short bubble on a high-lift wing will in general be beneficial unless the possible forward movement of the separation point leads to the formation of a long bubble. (Author)

Polytechnic Inst. of Brooklyn, N. Y.
PRESSURE AND LAMINAR HEAT TRANSFER DISTRIBUTION AT THE NOSE REGION OF A SEMI-CIRCULAR TOROID AT $M_\infty = 3$ AND 8, by Victor Zakkay and Marian Visich, Jr. Rept. on Contract AF 33(616)6118. July 60, 47p. 10 refs. ARL Technical note 60-127; PIBAL Rept. no. 547; AD-240 120.
Order from LC mi$3.30, ph$7.80 PB 149 749

The experimental results of the pressure and heat transfer measurements about a semicircular toroid having a ratio of minor to major radius equal to 0.255 are presented. Pressure distributions have been measured at $M_\infty = 3$ for several angles of attack and at zero angle of attack for $M_\infty = 8$. Heat transfer measurements were obtained at zero and 10° angles of attack at $M_\infty = 8$. The experimental pressure distribution over the body for all the conditions presented here is predicted satisfactorily by the modified Newtonian pressure distribution followed by a Prandtl-Meyer expansion. The experimental heat transfer results along the plane of symmetry are in good agreement with a theoretical two-dimensional analysis. Good agreement between experimental values and the two-dimensional analysis is also obtained for the heat transfer outside of the plane of symmetry by taking into account the effect of crossflow.

Polytechnic Inst. of Brooklyn, N. Y.
SOME ASPECTS OF DRAG REDUCTION FOR LIFTING WING-BODY COMBINATIONS AT SUPERSONIC SPEED, by Lu Ting. Rept. on Contract AF 18(600)694. May 58, 29p. 3 refs. PIBAL rept. no. 445; AFOSR-TN-58-423; AD-158 226.
Order from LC mi$2.70, ph$4.80 PB 147 804

It has been shown that favorable antisymmetric modifications of the fuselage near the mid-wing can provide significant drag reductions in lifting wing-body combinations. The investigation of the present report shows that for a prismatic body of rectangular cross section with given volume (or cross section area) mounted on a mid-wing of given span and swept back, the lift-drag ratio of the wing-body combination with the favorable antisymmetric modifications will be higher if the basic body has a lower height-width ratio.

Princeton U., N. J.
AN ANALYSIS OF THE EFFECTS OF PERFECT GAS PARAMETERS ON GAS TURBINE PERFORMANCE, by Andrew G. Hammitt. Rept. on Contract AF 49(638)465. Dec 59, 31p. 5 refs. Aeronautical Engineering rept. 500; AFOSR-TN-60-225.
Order from LC mi$3.00, ph$6.30 PB 149 755

The effect of different gases on the performance of a gas turbine cycle has been considered. If the gas is perfect, three parameters: specific heat ratio, speed of sound, and viscosity are sufficient to characterize its properties. The effects of specific heat ratio and speed of sound are more significant unless the viscosity exhibits very large variations. A gas of low specific heat ratio and high speed of sound is advantageous for the operation of the heat exchangers while a high specific heat ratio and low speed of sound makes the turbo machinery simpler. The best gas would depend on the relative cost of the different types of equipment. (Author)

Princeton U., N. J.
FREE MOLECULE FLOW OVER NON-CONVEX BODIES, by Ira M. Cohen. Rept. on Contract AF 49(638)465. Feb 60, 42p. 19 refs. Aeronautical Engineering rept. no. 497; AFOSR-TN-60-190.
Order from LC mi$3.30, ph$7.80 PB 149 754

The problem considered in this report is the determination of the velocity distribution function f and the heat transfer rate at any point on a surface of arbitrary shape immersed in a free molecule flow field. A theory is developed in which the mass flux incident on the surface of a non-convex body is expressed as the solution of an integral equation. Then, the fundamental transport properties at the surface are given in terms of appropriate integrals over velocity space. As an example, a hemisphere in an infinite speed ratio flow is considered. (Author)

Princeton U., N. J.
ON THE LIMITING STRUCTURE OF THE EDGE OF A HYPERSONIC BOUNDARY LAYER WITH VERY COLD FREE STREAMS, by N. C. Freeman, S. H. Lam. Rept. on Contract AF 49(638)465. May 59, 27p. 3 refs. Aeronautical Engineering rept. no. 468; AFOSR TN 59-690; AD-240 233.
Order from LC mi$2.70, ph$4.80 PB 149 753

The structure of the edge of a hypersonic boundary layer in the limit of zero free stream temperature is analyzed with conventional boundary layer approximations for a gas with arbitrary Prandtl number Pr and viscosity law $\mu \alpha T^s$. It is shown that for certain combinations of Pr and s the velocity profile has a discontinuity in slope at the edge of the boundary layer. The boundary layer thickness in this limit is always finite for $S > -1$. For $S < -1$ no limiting solution exists for any Pr. (Author)

Royal Coll. of Science and Tech., Glasgow (Scotland).
THE HODOGRAPH METHOD APPLIED TO FLOW PAST PROFILES AND IN JETS, by D. C. Pack. Technical final rept. on Contract AF 61(514)1170. Apr 60, 61p. 23 refs. AFOSR-[TR]-60-61.
Order from LC mi$3.90, ph$10.80 PB 150 038

A study of the two-dimensional, steady flow of a gas at sonic and near-sonic speed, and in particular, the flow past wedge-shaped bodies of finite length, placed in either an infinite stream, a jet or a (two-dimensional) wind-tunnel with parallel walls, has been made by using the equations of motion expressed in terms of hodograph variables.

Stanford U., Calif.
DEVELOPMENT OF A FINITE-DIFFERENCE METHOD FOR COMPUTING A COMPRESSIBLE LAMINAR BOUNDARY LAYER WITH INTERACTION, by I. Flügge-Lotz and Er-Yung Yu. Rept. on Contracts AF 18(600)1488 and AF 49(638)550. 15 May 60, 143p. 27 refs. Div. of Engineering Mechanics technical rept. no. 127; AFOSR-TN-60-577; AD-242 421.
Order from LC mi$7.20, ph$22.80 PB 150 340

The compressible laminar boundary layer equations in their original form, i.e., with u, v, i as dependent variables and x, y as independent variables, have been solved numerically by employing the explicit finite-difference method. The physical problems that have been treated are the two-dimensional boundary layer flows along a constant temperature wall with or without pressure variation. For each of the flow models considered the numerical solutions were obtained for the

following four different cases: (1) $M_\infty = 0.5$, $T_w/T_{ad} = 0.5$ (isothermal cooled wall); (2) $M_\infty = 0.5$, $T_w/T_{ad} = 2.0$ (isothermal heated wall); (3) $M_\infty = 3.0$, $T_w/T_{ad} = 0.5$; and (4) $M_\infty = 3.0$, $T_w/T_{ad} = 2.0$. In each case, flows with zero pressure gradient and those with positive ramp pressure gradient have been separately investigated. It is found that the explicit difference scheme works very satisfactorily for case (1). For cases (2) and (3) the difference scheme is found somewhat unstable in a narrow region next to the wall. Case (4), i.e., $M_\infty = 3.0$ and heated wall, is the worst condition so far encountered.

Stanford U., Calif.
STRUCTURES AND MATERIALS FOR FINITE LIFETIME, by N. J. Hoff. Technical rept. no. 1 on Contract Nonr-225(30). Aug 58, 60p. 25 refs. SUDAER no. 81.
Order from LC mi$3.60, ph$9.30 PB 150 052

The aerodynamic heating accompanying supersonic and hypersonic flight renders design for infinite lifetime impossible. At moderately high temperatures creep sets in and causes rupture in tension and buckling in compression even under relatively small loads if they act for a sufficiently long time. At extremely high temperatures the structural material, or its protective covering, melts, vaporizes, sublimes or burns. The analyst must be able to calculate the lifetime of the structural elements in order to ensure the safety of the structure. A few simple methods of analysis are presented in the report with the aid of which approximate calculations of the lifetime can be carried out. (Author)

Tiltman Langley, Ltd. (Gt. Brit.)
AN ITERATIVE ANALOGUE COMPUTOR FOR STUDY OF THE TURBULENT FLAME PROPERTIES OF ELEMENTARY COMBUSTION CHAMBERS, by A. J. Cooper and I. C. Hutcheon. Technical (scientific) note no. 3 on Contract AF 61(514)1213. 30 Nov 59, 35p. 11 refs. AFOSR-TN-60-993.
Order from LC mi$3.00, ph$6.30 PB 150 354

An iterative analogue computor has been designed and built for solving up to 20 simultaneous equations of the form $\tau_j = \frac{1}{L} \sum_k b_{jk} \psi(\tau_k)$ where L is an adjustable parameter (eigenvalue). b_{jk} is a set of up to 20 x 20 coefficients and ψ is a linear or non-linear relationship. Equations of this form arise in the study of turbulent flame patterns in combustion chambers. b_{jk} is then a set of influence coefficients which relate the local temperature τ_j at any point j to the rates of heat generation at k points throughout the flame, and ψ is a reaction rate function which relates the heat generated at any one point to its own temperature. The coefficients are measured by argon tracer methods using a flow of air through a model combustion chamber, and the computor has been used to predict extinction points for different combustion chamber configurations on the assumption of a theoretical reaction rate function. The computor operates in an iterative manner, approaching the correct solution by a series of successive approximations. The whole system is described, and operating and maintenance instructions are given.

University of Southern California. Engineering Center, Los Angeles.
OPERATION AND CALIBRATION OF THE LOW DENSITY WIND TUNNEL, by Raymond L. Chuan, Lee M. Springer, and Serge A. Waiter. Technical note on Contract AF 18(603)95. 15 July 60, 43p. 7 refs. USCEC rept. 56-215; AFOSR-TN-60-649.
Order from LC mi$3.30, ph$7.80 PB 149 959

For the experimental investigation of rarefied gas-dynamics a low density wind tunnel has been developed which is capable of producing flows at lower density, higher Mach number, higher temperature, and with a larger flow field than has been possible in the past, in order that slip, transitional and free molecule flows can be studied with large regions of interest susceptible to probing with appropriate instruments, and with flow durations sufficiently long to ensure equilibrium conditions in all measurements.

University of Southern California. Engineering Center, Los Angeles.
STUDIES IN THE HEATING OF A SUPERSONIC GAS STREAM BY A RADIO FREQUENCY DISCHARGE, by Frederick O. Smetana. Technical note on Contract AF 18(603)95. 15 July 60, 103p. 24 refs. USCEC rept. 56-214; AFOSR-TN-60-648.
Order from LC mi$5.70, ph$16.80 PB 149 958

The background and problem areas of the application of radio frequency discharge to heating a supersonic gas stream are discussed. An apparatus was constructed to permit the effectiveness of this technique to be studied by calorimetry. Results indicate that about 10% of the power taken from the a. c. line appeared as heat in the gas. Through modifications in the electrical circuitry this probably can be increased to 15%. This technique introduces a negligible percentage of unwanted contaminants. On the other hand, small quantities of C_4F_8 mixed with N_2 were found to decrease the N_2 recombination time substantially. Tests were also made using argon alone and mixed with nitrogen. Maximum gas temperatures at the end of the nozzle were obtained with argon alone, being 660°K. Limited spectroscopic and microwave interferometer investigations were also conducted. (Author)

Watervliet Arsenal, N. Y.
ELASTIC-PLASTIC ANALYSIS OF A CYLINDRICAL TUBE, by R. E. Weigle. Mar 60, 21p. 5 refs. Technical rept. WVTRR-6007.
Order from LC mi$2.70, ph$4.80 PB 146 396

This report contains an elastic-plastic analysis of a cylindrical tube subjected to an internal pressure P of sufficient magnitude to cause plastic deformation. Results are presented in graphical form for the open-end tube. Comparison with the plane strain case is made for a wall ratio $\frac{b}{a} = 2$.

Hydrodynamics, Hydraulics, and Hydrostatics

Avco-Everett Research Lab., Mass.
END EFFECTS IN MAGNETOHYDRODYNAMIC CHANNEL FLOW, by Frank Fishman. Rept. on Contract AF 04(647)278. June 59, 16p. 1 ref. Research rept. 78; formerly Research note 135; AFBMD-TN-59-5; AD-227 866.
Order from LC mi$2.40, ph$3.30 PB 147 828

Some effects associated with the termination of electrodes and magnetic field in an otherwise uniform magnetohydrodynamic channel flow are investigated theoretically. Because of the end effects, the electrodes may carry more, or less, current than the same length of electrode in the middle of a long channel; this leads to the definition of a length representing the end correction for current. Similarly a difference in the total force on the working fluid leads to a length representing the end correction for force. These lengths are calculated for various geometries. The electrical efficiency of a channel acting as a generator is computed for these same conditions. It is shown that the end effects decrease generator efficiency least if the magnetic field extends at least one-half a channel height beyond the end of the electrodes (for generators of high nominal efficiency). Under these conditions, and if the electrodes are not less than 1% of the channel height long, they have an effective length for current about 0.4 channel heights greater than their actual length. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
INVISCID MODES OF INSTABILITY OF FLOW, by W. H. Reid. Scientific rept. no. 1 on Contract AF 19(604)7236. May 60, 20p. 11 refs. AFCRC-TN-60-443.
Order from LC mi$2.40, ph$3.30 PB 149 804

The inviscid modes of instability in flow over a slightly concave wall are studied and it is shown that if $UdU/d\eta > 0$, where $U(\eta)$ is the unperturbed velocity distribution, then oscillatory solutions do not occur. For a velocity distribution in the form of two straight lines the problem can be solved exactly, and detailed results are given for the first two convective modes of instability. If the fluid is considered to be a perfect electrical conductor, then this flow can be completely stabilized by a transverse magnetic field of magnitude $\mu H^2/4\pi\rho = 0.5752\ U_0^2(\delta/R)$, the numerical coefficient here being not too sensitive to the form chosen for the mean velocity distribution. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
A LIOUVILLE THEOREM FOR SHALLOW-WATER WAVES, by R. E. Meyer. Technical rept. no. 21 on Contract Nonr-562(07). Oct 59, 39p. 11 refs. AD-227 828.
Order from LC mi$3.00, ph$6.30 PB 149 937

The non-linear equations governing 2-dimensional gravity waves on shallow water to the first approximation are shown not to possess any solutions free of limit lines at all points and times, except for the solution representing uniform motion. The proof involves a generalisation of the usual concept of solution, and a corresponding existence theorem is given by means of an explicit representation. An important part of the argument is based on a dual set of invariance concepts, but some new results concerning a singular partial differential equation are also required for the proof. (Author)

California Inst. of Tech., Pasadena.
ON CATHODIC PROTECTION IN CAVITATION DAMAGE, by Milton S. Plesset. Rept. on Contract Nonr-220(28). July 59, 35p. 8 refs. Engineering Div. rept. no. 85-12; AD-226 971.
Order from LC mi$3.00, ph$6.30 PB 147 793

An experimental procedure has been developed which makes possible accurate and reproducible determinations of cavitation damage. This procedure has been applied to a study of the effect of cathodic currents on cavitation damage. A series of experiments in which the test liquid was a solution of salt in water showed a reduction in cavitation weight loss for all of the materials examined when the test specimen was made the cathode of an electrolytic cell and when the conditions were such that gas was evolved at the specimen surface. This protective effect against cavitation damage increased with increasing magnitude of the cathodic current. These observations support the view that the protective effect was due to the layer of hydrogen gas evolved on the surface of the specimen. A similar protective effect was observed when the specimen was made the anode in a test liquid which was buffered distilled water; in this situation the gas evolved at the specimen surface is oxygen. Additional evidence for this protective mechanism of a gas layer on the specimen surface was found in a series of experiments in which voltage applied to the cell was reduced to a level at which no gas was evolved on the surface. There was no protective effect with the specimen cathodic or anodic. (Author)

California Inst. of Tech., Pasadena.
REMARKS ON CAVITATION IN TURBOMACHINES, by A. J. Acosta and A. Hollander. Rept. on Contract Nonr-220(24). Oct 59, 42p. 32 refs. Engineering Div. rept. no. 79.3.
Order from LC mi$3.30, ph$7.80 PB 149 514

Starting with the occurrence and discussion of the importance of cavitation in turbomachines, the development of the various stages of cavitation in a machine is reviewed, followed by a discussion of the various dimensionless parameters used to describe cavitating performance in a turbomachine. The calculations of optimum inlet diameter are carried out in terms of assumed acceptable cavitation parameters. Various methods of determining the minimum cavitation number before cavitation breakdown are explored, and a free streamline model of the flow in a simplified impeller is used to obtain theoretical estimates of the extent of cavitation as a function of blade geometry and angle of attack. Some recent work of the effect of the thermodynamic properties of the fluid on the cavitation performance is examined and the various assumptions used in these theories are criticized. (Author)

David Taylor Model Basin, Washington, D. C.
TRIPPING OF T-SHAPED STIFFENING RINGS ON CYLINDERS UNDER EXTERNAL PRESSURE, by E. H. Kennard. Nov 59, 37p. 6 refs. Rept. 1079; AD-229 825.
Order from LC mi$3.00, ph$6.30 PB 150 292

An approximate theory is developed for estimating the additional stresses caused by an initial tilt of a T-shaped stiffening ring located either inside or outside of a cylinder under uniform pressure and the buckling load for an ideal ring, without restriction to axisymmetric symmetry. In practical cases the results appear not to differ markedly from those of the axisymmetric case. (Author)

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
DYNAMIC PERFORMANCE OF SCALED SURFACE-PIERCING HYDROFOIL CRAFT IN WAVES, by Paul Kaplan and Winifred R. Jacobs. Rept. on Contract Nonr-263(14). June 59, 121p. 21 refs. Rept. no. 704.
Order from LC mi$6.30, ph$19.80 PB 147 887

This report describes a study of the motions in waves of a group of hydrofoil craft when the geometric size parameters are changed, assuming a constant forward speed. The purpose of the study is to determine how to change craft size in order to obtain sustained motion in the largest possible following sea. Four different methods of changing size (scaling the physical dimensions of the system) are considered, and a simplified analysis is carried out on the basis of the effects of the damping and natural frequency of the free-vibration mode (resonance considerations) and the variation of the wave forcing functions as functions of wave length for different values of the scale ratio.

Davidson Lab., Stevens Inst. of Tech., Hoboken, N. J.
LONGITUDINAL STABILITY OF SURFACE-PIERCING HYDROFOIL SYSTEMS FOR WATER-BASED AIRCRAFT, by Gerard Fridsma. Rept. on Contract Nonr-263(20). Oct 59, 42p. 12 refs. Rept. no. 732; AD-227 478.
Order from LC mi$3.30, ph$7.80 PB 149 866

A theoretical investigation was conducted on tandem surface-piercing hydrofoil configurations to define qualitatively the importance of geometric and hydrodynamic parameters which influence a system's longitudinal stability in smooth water. The hydrofoil system was analyzed on the basis of the linear theory of small disturbances without the presence of controls. A wide range of parameters including lift curve slope, dihedral, foil spacing, load, speed, equilibrium lift coefficient and chord and area distributions was investigated to determine their effect on the regions of stability. The results of this analysis are put in the form of design charts which illustrate the regions of stability and instability. These regions are bounded by an upper limit curve which is indicative of oscillatory divergent motions and a lower limit curve indicative of a continuously divergent motion. The results presented are applicable to hydrofoil equipped aircraft as well as hydrofoil equipped seacraft. (Author)

Institute of Engineering Research, U. of California. Berkeley.
WATER WAVES. I, by John V. Wehausen. Rept. on Contract Nonr-222(30). Aug 58, rev. July 59, 155p. Series no. 82, issue no. 6; AD-227 275.
Order from LC mi$7.50, ph$24.30 PB 148 165

Contents:
Mathematical formulation
- Coordinate systems and conventions
- Equations of motion
- Boundary conditions at an interface
- Boundary conditions on rigid surfaces

Preliminary remarks and developments
- Classification of problems
- Progressive waves and wave velocity; standing waves
- Energy
- Momentum
- Expansion of solutions in powers of a parameter

Theory of infinitesimal waves
- The fundamental equations; use of complex variables
- Other boundary conditions
- Some mathematical solutions
- Some simple physical solutions
- Group velocity and the propagation of disturbances and of energy

Institute of Engineering Research, U. of California, Berkeley.
WATER WAVES. II, by John V. Wehausen. Rept. on Contract Nonr-222(30). Sep 58, 174p. Series no. 82, issue no. 7; AD-227 274.
Order from LC mi$8.10, ph$27.30 PB 148 618

Contents:
The solution of special boundary problems
Two-dimensional progressive and standing waves in unbounded regions with fixed boundaries
Three-dimensional progressive and standing waves in unbounded regions with fixed boundaries
Problems with steadily oscillating boundaries
Motions which may be treated as steady flows
Waves resulting from pressure distributions
(See also PB 148 165)

Institute of Mathematical Sciences, New York U., N. Y.
EQUATION OF STATE AND PHASE TRANSITION OF THE SPHERICAL LATTICE GAS, by Walter Pressman and Joseph B. Keller. Rept. on Contract AF 49(638)341. Feb 60, 34p. 5 refs. Research rept. no. HT-5; AFOSR-TN-60-297; AD-235 375.
Order from LC mi$3.00, ph$6.30 PB 148 985

The spherical lattice gas is a modification of the ordinary lattice gas in which the occupation number of each cell is permitted to be any real number rather than ± 1. However the sum of squares of the occupation numbers is required to equal the number of cells. This permits one to evaluate the partition function by integrating over the surface of a certain sphere rather than by summing over lattice points on that surface. The partition function and the equation of state of the gas are evaluated in this way. It is found that in 3 dimensions the gas condenses, but not in 1 or 2 dimensions. Graphs of the phase transition curve and of the iso-

therms in 3, 2 and 1 dimensions are presented. The analytical work is simplified by taking advantage of the relationship between the properties of the lattice gas and of the Ising model of a ferromagnet. This relationship, demonstrated by C. N. Yang and T. D. Lee [Phys. Rev. 87:410-419, 1952] for the ordinary lattice gas and Ising model, also applies to the spherical lattice gas and the spherical model of a ferromagnet. The properties of the latter were evaluated by T. H. Berlin and M. Kac [Phys. Rev. 86:821-835, 1952]. Graphs of the isotherms of the spherical model of the magnet, which were found in the course of the work, are also presented. (Author)

Laboratoire de Physique Théorique et Hautes Energies, Faculté des Sciences, Orsay (France).
ON THE THEORY OF CLASSICAL FLUIDS, by Loup Verlet. Technical note no. 18 on Contract AF 61(052)173. [1959] 35p. 16 refs. AFOSR-TN-60-689; AD-240 348.
Order from LC mi$3.00, ph$6.30 PB 149 589

An integral equation is established for the three-body correlation function in classical fluids. This equation contains a main equation which is very simple and correction terms. The solution of the main equation appears at first rather easy, but it is a highly non linear equation.

Princeton U., N. J.
CONCENTRATION DISTRIBUTION IN TWO-PHASE PIPE FLOW, by S. L. Soo and J. A. Regalbuto. Rept. on Project Squid, Contract Nonr-1858(25). Nov 59, 30p. 10 refs. Technical rept. PR-101-P; AD-229 223.
Order from LC mi$2.70, ph$4.80 PB 149 495

Concentration distribution of solid particles in 2 phase turbulence pipe flow was studied. Analytical consideration of momentum transport from the wall suggests a force field toward the center of the pipe opposing the mechanism of turbulent diffusion of solid particles. This gives rise to a nonuniform distribution of solid particles in steady and fully developed turbulent pipe flow. Experimental determination of concentration distribution was made with an impact disk particle counter system. (Author)

Princeton U., N. J.
SOME EFFECTS OF PARTICLE-PARTICLE AND PARTICLE-FLUID INTERACTION IN TWO PHASE FLOW SYSTEMS, by Richard L. Peskin. Rept. on Project Squid, Contract Nonr-1858(25). Oct 59, 151p. 41 refs. Technical rept. PR-97-T-R; AD-226 990.
Order from LC mi$7.50, ph$24.30 PB 149 869

The intensity of motion and the diffusivity of a single particle suspended in a turbulent fluid is discussed. The statistical behavior of particle motion is considered for the case of an isolated particle and for the case in which other similar particles present in the fluid exert pressure forces on the particle. (Author)

Rocketdyne, Canoga Park, Calif.
SOME COMMENTS ON PUMP CAVITATION RESEARCH, by A. J. Acosta (Calif. Inst. of Tech.) and G. F. Wislicenus (Pennsylvania State U.). Rept. on Study of Unconventional Methods for Alleviating Cavitation Problems in Rocket Pump Systems, Contract AF 33(616)5785. June 60, 25p. 28 refs. Excerpts from rept. R-1705; WADD Technical note 60-23.
Order from OTS $0.75 PB 161 952

Comments by Prof. A. J. Acosta and Prof. G. F. Wislicenus concerning pump cavitation research are presented. They are excerpts from a contract status report by Rocketdyne Division and originated in connection with a proposed study of fluid injection around a single cavitating hydrofoil. Both commentators question very strongly the value of such tests for present day pump cavitation research. Prof. Acosta points out in particular the general ineffectiveness of fluid injection as a means for cavitation control. As an extension to his comment, a theoretical analysis, previously advanced by Prof. Acosta, for the flow in a cavitating cascade is added. Prof. Wislicenus discusses in detail three-dimensional effects in pump cavitation and suggests also ways for attacking the associated problems. (Author)

St. Anthony Falls Hydraulic Lab., U. of Minnesota, Minneapolis.
INSTABILITY OF VENTILATED CAVITIES, by E. Silberman and C. S. Song. Rept. on Contract Nonr-710(24). Nov 59, 47p. 6 refs. Technical Paper no. 29, Series B; AD-237 387.
Order from LC mi$3.30, ph$7.80 PB 148 010

Cavitation number σ is defined by $\sigma = (p_o - p_k)/q$. It can be controlled by controlling the dynamic pressure q, the ambient pressure p_o, or the internal cavity pressure p_k. Controlling p_k by adding air to the wakes of fully submerged bodies (called ventilation) is investigated. With p_o and q fixed, p_k increases nearly linearly with the rate of air supply. Once σ was decreased to a certain critical value, further increase in the air supply rate would not produce a continuing linear decrease in σ. Rather, σ remained nearly constant and the cavities began to vibrate. Both two-dimensional and finite aspect-ratio bodies were tested in the two-dimensional, vertical, free-jet water tunnel.

Technion Research and Development Foundation, Ltd. (Israel).
RESEARCH ON CROSS-STRESSES IN THE FLOW OF LIQUIDS, by Markus Reiner. Technical rept. for 1 Mar 59-28 Feb 60 on Contract AF 61(052)223. [1960] 24p. 6 refs. AFOSR-TN-60-996.
Order from LC mi$2.70, ph$4.80 PB 150 357

Cross-stresses in the laminar flow of liquids. It is shown that cross-elasticity effects exist in a simple homogeneous liquid such as toluene. These effects manifest themselves in cross-stresses observed in an instrument consisting of two circular metal plates, one stationary, the other rotating opposite it. The stator can be displaced along the axis of rotation against forces exerted by springs. Stator and rotor are in contact when at rest. When the rotor is brought into rotation, cross-stresses in the liquid separate stator and rotor and a bearing effect is produced. Centripetal air-pump operated electromagnetically. Reprinted from the British Jnl. of Applied Physics 10:54-55, Jan 59.

METALLURGY

Brown U. Div. of Engineering, Providence, R. I.
AN EXPERIMENTAL DESIGN FOR VIBRATORY LIQUID SINTERING, by Dogan E. Gücer. Rept. on Contract DA 19-020-ORD-4888. June 60, 24p. 6 refs DA-4888/4; OOR rept. 2060. 4-Met.
Order from LC mi$2.70, ph$4.80 PB 150 398

This report describes an experimental set-up for measuring and controlling the vibrational energy input into a WC-Co liquid sintering specimen inside a high temperature hydrogen furnace. The control of input energy is achieved by proper acoustic design of the wave path and the measurement of dynamic strain amplitudes along this path. A method of calculation of the energy transmitted through the interface between the transmission bar and liquid sintering specimen and of the dynamic variables inside the specimen is proposed. The reproducibility of dynamical measurements and of alloy microstructures are also discussed. The same arrangement can easily be adapted to other applications. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DESIGN INFORMATION ON PH 15-7 Mo STAINLESS STEEL FOR AIRCRAFT AND MISSILES, by R. J. Favor, O. L. Deel, and W. P. Achbach. Rept. on Contract AF 18(600)1375. 22 Aug 60, 43p. 9 refs. DMIC rept. 135.
Order from OTS $1.25 PB 151 093

This report is a summary of design information pertinent to the use of PH 15-7 Mo stainless steel in aircraft and missile applications. Welding problems are discussed briefly. Data on the elevated-temperature mechanical properties of this alloy have been collected and evaluated. The presentation and evaluation of these data are in accordance with procedures employed by the ASTC-5 Committee. (Author)

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF REFRACTORY METAL SHEET IN THE UNITED STATES, by R. I. Jaffee, W. J. Harris, Jr., and N. E. Promisel. Rept. on [Contract AF 18(600)1375]. 20 Sep 60, 12p. DMIC memo. 67.
Order from OTS $0.50 PB 161 217

Text of a talk presented at the Conference on Niobium, Tantalum, Molybdenum, and Tungsten, held at the University of Sheffield, 20-22 Sep 60.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
RECENT DEVELOPMENTS IN SUPERALLOYS, by H. L. Wagner. Rept. on Contract [AF 18(600)1375]. 8 Sep 60, 14p. DMIC memo. 64.
Order from OTS $0.50 PB 161 214

A significant expansion of the operating limits of superalloys has been brought about in the past few years with the development of over a dozen new nickel-base and cobalt-base materials. Some of these alloys are fabricable into sheet, while others are suitable only for precision casting. Both, of course, have their advantages and disadvantages. The purpose of this memorandum is to highlight some of the newer superalloys and to discuss some of their important properties and characteristics.

Illinois U., Urbana.
AN INVESTIGATION OF THE USE OF INTERNAL FRICTION TECHNIQUES IN THE STUDY OF DIFFUSION AND PHASE CHANGES IN METALS, by James Cost and Charles Wert. Final rept. on Contract AF [18](603)22. 15 May 60, 34p. AFOSR-TR-60-83.
Order from LC mi$3.00, ph$6.30 PB 149 595

Contents:
Studies of phase separation in Au-Ni alloys
Anelasticity in alloys of Cd with Mg
The effect of ferromagnetism on diffusion
Studies of the group VB metals and their equilibrium with oxygen and nitrogen
The internal friction of Hf.

Institute of Metals and Explosives Research, U. of Utah, Salt Lake City.
OBSERVATION OF VAPORIZATION ACCOMPANYING ULTRA-HIGH VELOCITY IMPACT, by R. W. Bartlett. Rept. on Contract AF 18(603)100. 4 Jan 60, 26p. 9 refs. AFOSR-TN-60-327; AD-237 546.
Order from LC mi$2.70, ph$4.80 PB 148 013

The explosive techniques employed were capable of generating velocities sufficiently high to produce target vaporization in many metals. These impact-generated vapors were sufficiently luminous for short periods of time to be photographed, and they exhibited considerable electrical conductance evidencing a high degree of ionization which decayed faster in air and various inert gases than in vacuum. Because of the high luminosity and the ionization of the impact-generated metal vapors or plasmas high-speed framing camera techniques and electrical conductivity measurements were employed. Small quantities of the condensed vapors also were collected and analyzed quantitatively to determine the ratios of the projectile or jet to target metals in the vapor condensate as a function of impact velocity. In most cases mixtures of metal oxides were indicated but the X-ray diffraction patterns did not permit conclusive identification of specific compounds. Some condensation of reduced metal also was observed (aluminum, iron and zinc) and a substitutional solid solution alloy, alpha brass, was produced by the simultaneous condensation of copper and zinc vapors originating from different targets impacted in tandem. (Author)

Westinghouse Electric Corp., Bloomfield, N. J.
PHYSICAL METALLURGY OF TUNGSTEN AND TUNGSTEN BASE ALLOYS, by Russell H. Atkinson. Rept. for 1 Apr 58-30 Nov 59 on Metallic Materials, Contract AF 33(616)5632. May 60, 251p. 90 refs. WADD Technical rept. 60-37.
Order from OTS $4.00 PB 161 978

The program provided base line data and fundamental physical metallurgical information on tungsten of various purity levels. High temperature tensile properties and recrystallization temperature could not be directly correlated with the impurity level. The tensile transition temperature of tungsten single crystals lies between - 196°C and 107°C, the main influence being surface condition. Polycrystalline tungsten internal friction peaks of undetermined origin in the 20° - 800°C region. Annealed single crystals show no such behavior. Alloying with a dispersed second phase was studied; at present W-2% ThO_2 offers the greatest improvement in high temperature properties data on alloying studies are incomplete. (Author)

Ferrous Metals

Aeronautical Materials Lab., Naval Air Material Center, Philadelphia, Pa.

A STUDY OF THE MINIMIZATION OF THE ADVERSE EFFECTS OF CHROME PLATING ON THE FATIGUE LIFE OF AISI 4340 STEEL AND THE CORRELATION OF FATIGUE AND ELASTIC LIMITS, by Joseph Viglione. Rept. on Proj. TED NAM AE 4110, pt. 13. 20 July 59, 38p. 3 refs. Rept. no. NAMC-AML-AE-1098.
Order from LC mi$3.00, ph$6.30 PB 150 787

This report released for sale to the public 11 Oct 60.

The effect of shot-peening prior to and baking after chrome plating AISI 4340 steel was investigated at strength levels up to 295,000 psi. It was found that this treatment had excellent beneficial effects on the fatigue limits of chrome plated 4340 steel at all the strength levels likely to be used in aircraft construction. It was determined that there was no relationship between the fatigue limits and any of the other mechanical properties of the plated steel. In the case of the unplated steel, it was established that there was a definite straight-line functional correlation between the fatigue limit to elastic limit ratios and the tensile strength levels of the steel. (Author)

Battelle Memorial Inst., Columbus, Ohio.

DETERMINATION OF THE CAUSES OF WELD-METAL CRACKING IN HIGH-STRENGTH STEELS AND THE DEVELOPMENT OF HEAT-TREATABLE LOW-ALLOY-STEEL FILLER WIRES FOR USE WITH THE INERT-GAS-SHIELDED ARC-WELDING PROCESS, by Herbert W. Mishler, Robert E. Monroe, and Perry J. Rieppel. Rept. for 16 June 58-30 July 59 on Welding, Brazing, and Solering of Metals, Contract AF 33(616)5878. May 60, 60p. 12 refs. WADC Technical rept. 59-531.
Order from OTS $1.50 PB 161 981

The work conducted under this contract was divided into four phases: three dealt with the study of the causes of weld-metal-cracking in SAE 4340 steel and the fourth was concerned with the study of filler wires for producing welds heat treatable to ultimate-tensile-strength levels greater than 225,000 psi. Freezing-cycle hot-tension studies were made on various heats of SAE 4340 steel containing yarious sulfur and phosphorus contents. Results indicated that the combined sulfur and phosphorus contents of SAE 4340 steel should be kept below 0.025 per cent to prevent weld-metal hot cracking. An intergranular phase believed to be associated with hot cracking was found during light and electron microscopy of high-phosphorus SAE 4340 steels. This phase was tentatively identified as the iron-iron phosphide euctectic. Two new restrained weld-metal-cracking tests were developed that will give a quantitative measure of weld-metal-cracking resistance and which also will be inexpensive to conduct. Filler wires were developed which can produce weld metals capable of being heat treated to various strength levels in the range of 225,000 to 280,000 psi ultimate tensile strength. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.

AN X-RAY ANALYSIS OF THE STRAIN IN STEEL DUE TO IMPULSIVE LOADS, by G. Moss, S. Golaski and C. Glass. June 60, 12p, 5 refs. Technical note no. 1320.
Order from LC mi$2.40, ph$3.30 PB 149 884

A rod of pearlitic 1030 steel was subjected to an impulsive load, recovered, and analyzed for X-ray diffraction line broadening at a cross section which had been exposed to a maximum pressure of approximately 35 kilobars. The broadening of the diffraction peaks was then plotted versus $\sec\theta$ and θ in order to establish whether or not the primary mode of deformation was due to lattice fragmentation or micro-strain. The results indicated that deformation was not simple enough to be interpreted according to either of these models, for the broadening was probably due to both micro-strain and lattice fragmentation. (Author)

Naval Research Lab., Washington, D. C.

CRACK PROPAGATION TESTS OF HIGH-STRENGTH SHEET MATERIALS. PART V. AIR-MELTED AND CONSUTRODE AMS 6434 STEEL, by C. D. Beachem and J.E. Srawley. 18 Aug 60, 22p. 4 refs. NRL rept. 5507.
Order from OTS $0.75 PB 161 697

Crack propagation tests were conducted on air-melted and consumable-electrode vacuum-remelted SAE Aeronautical Materials Specification 6434 (modified AISI 4335 with vanadium), using specimens 1/2 in. or 1-1/2 in. wide and up to 0.125 in. thick, and heat-treated to have yield strength in the range 180 to 210 ksi. The full shear temperatures obtained with the different thicknesses and heat treatments were lower than those of any other steels of comparable thicknesses and yield strengths that have been tested to date, and the net fracture stress values were similarly superior. The consutrode material was significantly better than the air-melted material. Limited data indicated that the transverse properties were not significantly inferior to the longitudinal properties. The FST was higher the thicker the material, as previously observed for other materials. Austenitizing at 1620°F gave better results than at 1575°F, and tempering at 400°F gave better results than at 725°F. (Author) (See also PB 161 355)

Rodman Lab., Watertown Arsenal, Mass.
IMPROVED STEELMAKING PRACTICES ENHANCE THE MECHANICAL PROPERTIES OF HIGH STRENGTH STEEL CASTINGS, by John Zotos, and Kenneth D. Holmes. May 60, 26p. 13 refs. Rept. RPL 10/25.
Order from LC mi$2.70, ph$4.80 PB 149 560

Recent advances in the basic-electric and basic-induction atmospheric and vacuum steelmaking practices have, (1) clarified the necessity of minimizing phosphorus and sulphur contents in cast low alloy steels to maximize ductility and toughness at low, medium and high strength levels, (2) shown that the ductility and toughness of these cast steels can be further significantly improved through the use of vacuum melting and casting techniques, and (3) indicated that the mechanical properties of heat treated castings with low sulphur contents compare favorably with the properties of forgings having similar analyses. (Author)

Light Metals

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
THE EFFECT OF RATE OF HEATING TO AGING TEMPERATURE ON THE TENSILE PROPERTIES OF Ti-2, 5Al-16V ALLOY SHEET, by G. S. Root and H. R. Ogden. Rept. on [Contract AF 18(600)1375]. 18 Aug 60, 11p. 3 refs. DMIC memo. 62.
Order from OTS $0.50 PB 161 212

The experiment described in this memorandum was designed to correlate tensile properties of aged Ti-2.5Al-16V alloy sheet, heated to aging temperature at various rates, with the quench and reheat time-temperature-transformation diagram developed for this alloy by the Armour Research Foundation. Specifically, the effects of three variables on aged strength and elongation were studied: (1) The effect of rate of heating to aging temperature, (2) the effect of minor variations in total time during aging, and (3) the effect of a low-temperature pre-aging treatment to obtain omega phase.

Defense Metals Information Center, Battelle Memorial Inst., Columbus, Ohio.
TANTALUM AND TANTALUM ALLOYS, by F. F. Schmidt. Rept. on Contract AF 18(600)1375. 25 July 60, 334p. 287 refs. DMIC rept. 133.
Order from OTS $5.00 PB 151 091

A descriptive literature survy has been made covering physical properties, process metallurgy, binary and ternary alloy systems, chemical properties and metallurgical properties of tantalum and tantalum alloys. The properties of tantalum are well reported; however, investigations concerned with the effects of interstitial and substitutional alloying elements on the properties of tantalum are limited. Tantalum has only moderate strength at room temperature; however, the elevated-temperature strength decreases slowly in comparison with that of many other metals. The low ductile-to-brittle behavior, excellent fabricability, high melting point, and high solubility for interstitial and substitutional elements make tantalum an attractive candidate for use in high-temperature high-strength alloys. Refractory metals that exhibit brittle behavior at room temperature, such as molybdenum and tungsten, can be alloyed with tantalum to form tantalum-base alloys with a combination of high-temperature strength and low-temperature ductility not found in many metallic materials designed for ultra-high-temperature service. (Author)

Nonferrous (except light) Metals

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
PROPERTIES OF ZONE REFINED TITANIUM AND ZIRCONIUM. PART I, by J. L. Rutherford, R. L. Smith, and M. Herman. Rept. on Contract AF 18(600)1581. July 60, 33p. 4 refs. Interim rept. I-A1878-6; AFOSR-TN-60-694.
Order from LC mi$3.00, ph$6.30 PB 149 955

The properties of zone refined titanium and zirconium are presented and evaluated. Surveys of the properties along the length of the zone refined bars are shown which indicate a definite redistribution of impurities as well as some actual purification. The results of tensile tests at 4.2°K and the origin of the serrations appearing in these tensile curves are discussed. (Author)

Pitman-Dunn Labs. Group., Frankford Arsenal, Philadelphia, Pa.
RADIATION INDUCED RESISTIVITY CHANGES IN NICKEL, by D. B. Rosenblatt. Mar 60, 10p. 7 refs. Memo. rept. M60-29-1; AD-239 656.
Order from LC mi$1.80, ph$1.80 PB 149 792

Previous research with room temperature irradiations of nickel wire revealed anomalies in the increase of the electrical resistivity of this material. Comparison of results obtained by different investigators suggests that the excess resistivity saturates at very low values of integrated flux and does not anneal out in a reproducible fashion. The experiments reported here verify the existence of this anomalous behavior and provide additional data for various radiation doses. The annealing of the excess resistivity produced by cold work is studied and found to follow a smooth curve, with significant rates of disappearance of defects in the temperature range right above room temperature. The relationship between this behavior and the irreproducibility of data obtained with irradiated specimens is discussed. (Author)

Structural Metallurgy and Corrosion

American Machine and Foundry Co., Alexandria, Va.
ULTRA-SHORT-TIME CREEP RUPTURE, by Joseph S. Ives, Jr. Rept. for 2 Feb-31 Oct 59 on Materials Analysis and Evaluation Techniques, Contract AF AF 33(616)5557. May 60, 131p. WADC Technical rept. 59-762, Pt. 2.
Order from OTS $2.75 PB 161 983

The short time creep behavior of eight structural sheet materials when subjected to temperatures up to 2,000°F was determined for time periods of 10 seconds to three minutes. The test specimens were preloaded and subsequently heated to the desired test temperature within 100 milliseconds through capacitance discharge. Test temperature was then maintained by an a.c. current. Strain-time, isochronous stress-strain and stress-time curves are presented. Initial transient behavior due to thermal expansion is also reported. (Author) (See also PB 161 789)

Armour Research Foundation, Chicago, Ill.
THE DETERMINATION OF THE EFFECTS OF ELEVATED TEMPERATURES ON THE STRESS CORROSION BEHAVIOR OF STRUCTURAL MATERIALS, by Frank A. Crossley, Carl J. Reichel, and Charles R. Simcoe. Rept. on Materials Application, Contract AF 33(616)6392. May 60, 59p. 39 refs. WADD Technical rept. 60-191.
Order from OTS $1.50 PB 161 962

The dissolution rates of anodized oxide films on Ti-6Al-4V alloy were determined from 800° to 1000°F. Coefficients for oxygen diffusion in Ti-6Al-4V alloy are given by D, $cm^2/sec = 2.87 \times 10^4 \exp(-67,900 \pm 300/RT)$. Experiments showed conclusively that oxide film protection is lost by direct reaction with chloride salt. Elevated-temperature creep testing in the presence of chloride salt was found to be detrimental to post-exposure tensile properties of the materials: 17-7 PH, stainless Type 321, Inconel-X, and B 120-VCA. Materials exhibiting premature failure with greatly reduced ductility in tension static fatigue tests at room temperature in the presence of 10% chloride salt aqueous solution were: 2024T-86 Al alloy, ZK-60 Mg alloy, 17-7 PH, and B 120-VCA. The materails 2024T-86, Ni-plated 17-22 AS, 17-7 PH, Lapelloy, Type 321 stainless, and B 120-VCA were tested for JP-4 fuel stress-corrosion. Except possibly for 2024T-86, no susceptibility was found. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
SOME MICROSCOPIC OBSERVATIONS OF CRACKS DEVELOPED IN METALS BY VERY INTENSE STRESS WAVES, by G. Moss and C. M. Glass. Apr 60, 19p. 4 refs. Technical note no. 1312; AD-237 943.
Order from LC mi$2.40, ph$3.30 PB 148 913

Explosively induced stress waves were propagated through various metals so that scab type fractures resulted. Microscopic examinations were then made of the metal adjacent to the fracture surfaces. In each case, the fractures began at imperfections within a thin plate of metal that was parallel to and included the observable fracture surface. The thickness and position of this plate within the metal appears to be a function of the inclusions present, subboundaries and crystal orientation. It is concluded that these metallurgical factors influence the response of metals even under explosive loading. (Author)

Food Machinery and Chemical Corp., Buffalo, N. Y.
EFFECT OF COUPLING OF ALUMINUM OR STAINLESS STEEL ALLOYS TO ALUMINUM ON CORROSION BY 90% HYDROGEN PEROXIDE, by L. Goldschlag. Final rept. for 1 Feb-28 Oct 58 on Contract NObs-72383. [1958] 50p. 5 refs. Rept. 91:49-4; AD-212 846.
Order from LC mi$3.30, ph$7.80 PB 150 293

A study of the galvanic corrosion caused by coupling of stainless steels to aluminum alloys and of aluminum alloys to other aluminum alloys in 90% hydrogen peroxide containing chloride and nitrate ions has been completed. During a one-month period, galvanic corrosion was essentially unnoticeable in solutions containing 0 and 3 mg/l chloride but apparent at 10 mg/l. Data on the pronounced effect of chloride, and of anodizing the aluminum, and general data on chemical corrosion of aluminum was obtained. (Author).

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
A CINEPHOTOMICROGRAPHIC STUDY OF THE ETCHING OF ZINC, by S. Tint and V. V. Damiano. Rept. on Contract AF 18(600)1581. July 60, 12p. 4 refs. Interim rept. I-A1878-8; AFOSR-TN-60-696.
Order from LC mi$2.40, ph$3.30 PB 149 956

A device was constructed to photograph, on motion picture film, the continuous formation of etch patterns on zinc monocrystals. This apparatus consists of : (1) a transparent cell to hold sample and etchant; (2) a microscope with vertical illuminator; and (3) a motion picture camera driven by an electric motor. Several sequences of these pictures are reproduced, showing looplike patterns similar in appearance to the Frank-Read dislocation source. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
DISLOCATIONS AND IMPURITY BOUNDARIES IN ZINC CRYSTALS GROWN FROM THE MELT, by V. V. Damiano and S. Tint. Rept. on Contract AF 18(600)1581. July 60, 15p. 10 refs. Interim rept. I-A1878-9; AFOSR-TN-60-697.
Order from LC mi$2.40, ph$3.30 PB 150 127

Using etch pit techniques, the arrangement of dislocations in cadmium doped high purity zinc crystals grown from the melt was investigated. Crystals which exhibit a cellular segregation structure at a decanted interface were progressively polished and etched to a depth of several millimeters behind the interface. The location of the etch pits at microsegregation and their arrangement into networks is in agreement with Tiller's hypothesis that dislocations are introduced during solidification to accommodate the lattice strain induced by the inhomogeneous distribution of impurities. Networks form when the dislocations are set free after homogenization occurs behind the solid-liquid interface. The dislocations then become arranged in walls perpendicular to the slip plane by climbing away from the impurity boundaries. This secondary substructure fully developed 3 mm behind the solid-liquid interface increases in size as the crystal continues to grow and the dislocations climb and glide. (Author)

Franklin Inst. Labs. for Research and Development, Philadelphia, Pa.
PROPERTIES OF ZONE REFINED TITANIUM. PART II, by G. Spangler and M. Herman. Rept. on Contract AF 18(600)1581. July 60, 38p. 22 refs. Interim rept. I-A1878-7; AFOSR-TN-60-695.
Order from LC mi$3.00, ph$6.30 PB 150 126

The recrystallization characteristics, grain growth kinetics, residual resistivity ratio and mechanical deformation characteristics of zone refined titanium are presented and discussed. Both the ultimate purification and the redistribution of impurities in the zone refined material have been evaluated in terms of these operational parameters. Observations are presented and discussed on the effect of purity and grain size on the tendency for discontinuous plastic flow at 4.2°K. (Author)

General Electric Co., Evendale, Ohio.
GAS ATMOSPHERE EFFECTS ON MATERIALS, by R. A. Baughman. Rept. for Apr 58-Apr 60 on Aircraft Fuels, Contract AF 33(616)5667. May 60, 232p. 11 refs. WADC Technical rept. 59-511.
Order from OTS $3.50 PB 161 980

Effects of a special water saturated gas atmosphere on the properties of structural materials was studied at elevated and low temperatures. Parent material as well as welded and brazed joints were subjected to tensile, impact and strain aging tests. Fundamental mechanism and coating study was accomplished on Inco 702, which had proved the most sensitive to the gas environment. This report includes all data obtained and detailed discussion of results. The high temperature rupture strength of each alloy studied was shown to be reduced below the corresponding air atmosphere strength by the special gas. Low temperature properties were shown to be independent of the environmental effects studied. The basic mechanism effecting the high temperature properties has not been clearly determined. (Author)

James Forrestal Research Center, Princeton, N. J.
OXIDATION OF METALS AND ALLOYS, by C. E. Birchenall. Final rept. for 1 Jan 59-30 June 60 on Contract AF 49(638)533. 1960, 19p. AFOSR-TR-60-96.
Order from LC mi$2.40, ph$3.30 PB 150 138

This project has contributed to the following subjects: (1) the establishment of an unusual variation in self-diffusion coefficient in alpha iron in the temperature range containing the Curie point; (2) effects of disorder on thermodynamic properties in manganous oxide and on diffusion in ferrous sulfide; (3) the mechanism and kinetics of oxidation of iron-chromium alloys containing up to ten percent chromium; (4) the mechanism of sulfidation of iron; (5) equilibria in the chromium-sulfur system; (6) the effects of interstitial sites, in which ions are nearly as stable as in lattice sites, on the frequency factor in the rate equation for diffusion; (7) self-diffusion of iron in spinel ferrites of several compositions; and (8) self-diffusion in delta-iron.

Metals and Ceramics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
ELEVATED TEMPERATURE DYNAMIC MODULI OF VANADIUM TITANIUM AND V-Ti ALLOYS, by W. H. Hill and B. A. Wilcox. Rept. for Oct 59-Apr 60 on Metallic Materials. May 60, 16p. 9 refs. WADD Technical rept. 60-245.
Order from OTS $0.50 PB 171 014

The dynamic moduli of calcium-reduced vanadium, high grade aluminothermic vanadium, iodide titanium and Ti-75A alloy were determined over the temperature range R. T. to 1250°F. In addition, elevated temperature dynamic modulus data were obtained for five V-Ti alloys, having nominal compositions of V-8Ti, V-17Ti, V-25Ti, V-32Ti, and V-48Ti. The decrease in modulus of vanadium with increasing temperature was found to be relatively small as compared to iodide Ti and Ti-75A. Solid solution additions of Ti were observed to lower the modulus of V over the entire temperature range studied, but the additions did not affect the slope of the modulus versus temperature curve. An empirical correlation relating modulus to density, absolute melting point, and atomic weight was successfully applied to vanadium and V-Ti alloys, such that good agreement was realized between the ratios of E_v/E_{alloy} (calculated) and E_v/E_{alloy} (measured). (Author)

Metals and Ceramics Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
STRESS CORROSION OF NOTCHED AND UNNOTCHED AM-350 ALLOY, by Robert T. Ault. Rept. for Sep-Dec 59 on Materials Analysis and Evaluation Techniques. May 60, 14p. 3 refs. WADD Technical note 60-95.
Order from OTS $0.50 PB 161 998

One of the precipitation hardness stainless steel alloys (AM-350) was tested for stress corrosion susceptability in the notched and unnotched condition. A 3 1/2% sodium chloride solution was used. With the specimen stressed to 60% of the 0.2% offset Y. S., it was found that all of the unnotched specimens had failed within 150 hours and none of the notched specimens had failed after 800 hours. It was concluded that stress-raisers such as mechanically induced notches do not have an appreciable effect on the susceptability of an alloy to stress corrosion cracking (SCC). Rather the more important factor is local surface defects or inhomogeneities in the material. It was also found that concentration cell corrosion may be an important consideration for the AM-350 alloy. (Author)

Naval Engineering Experiment Station, Annapolis, Md.
EVALUATION OF TITANIUM AS A SALT WATER PIPING MATERIAL, by Frank Sutton. 15 Sep 58, 12p. 9 refs. Evaluation rept. 910037D; AD-212 792.
Order from LC mi$2.40, ph$3.30 PB 147 563

An experimental salt water piping system to evaluate titanium for piping applications operated for 39 months at a water velocity of 20 ft/sec. The titanium pipe and fittings exhibited complete resistance to salt water corrosion and erosion.

New York U. Coll. of Engineering, N. Y.
FURTHER STUDIES ON ACTIVE-EUTECTOID ALLOYS OF TITANIUM, by R. F. Bunshah, D. Osterberg and others. Rept. for 15 Apr 58-30 Sep 59 on Metallic Materials, Contract AF 33(616)5655. May 60, 80p. 26 refs. WADD Technical rept. 60-95.
Order from OTS $2.00, PB 161 964

This report covers work on active eutectoid titanium-copper alloys in which the decomposition of the beta phase to alpha plus compound occurs rapidly. The current program is divided into two parts. Part I deals with the properties of active eutectoid alloys. The effect of stepwise additions of Al and/or Zr to binary Ti-5Cu, Ti-6Cu, Ti-6Ni, Ti-2Ni-2Cu and Ti-4Ni-2Cu alloys on the tensile strength at room and elevated temperatures, creep-rupture properties and thermal stability under stress were studied. Several alloys exhibited outstanding short time tensile strengths up to 1200°F much superior to the best competition. The creep-rupture properties were correspondingly good. These alloys which exhibited highest strengths also showed instability. Stability could be restored partially by some sacrifices in strength. (Author)

Physical Science Lab., Ordnance Tank-Automotive Command, Center Line, Mich.
VACUUM DEPOSITION OF CORROSION RESISTANT TITANIUM COATINGS, by David K. Wilburn and Charles W. Horn. Rept. on Contract DA 20-089-ORD-39246. Feb 60, 57p. 23 refs. Rept. no. RR-12.
Order from LC mi$3.60, ph$9.30 PB 149 809

A process has been developed for the production of vacuum metallized coatings of titanium for application on ferrous basis metals. Conditions of surface preparation, degassing of basis metal and the vaporization of the titanium are discussed in detail. Metallized titanium coatings are examined by spectrographic and X-ray diffraction techniques. An important phase of the titanium metallization process is the diffusion treatment of the coating which produces adhesion and reduces porosity. Laboratory samples metallized in accordance with this procedure satisfactorily pass the 200 hour salt-fog corrosion test and exhibit excellent adhesion and uniformity. (Author)

Rock Island Arsenal Lab., Ill.
EFFECTS OF VARIATIONS IN SILICON AND MANGANESE ON THE AS-CAST PROPERTIES OF NODULAR CAST IRONS, by P. E. Goettsch.
17 Feb 60, 17p. Rept. no. 60-406; AD-234 987.
Order from LC mi$2.40, ph$3.30 PB 147 342

Silicon levels ranging from 2.4 to 3.5% with manganese levels of 0.2 to 2.0% were used in a series of sixteen separate heats of nodular cast iron in order to study the effects of various concentrations of these elements on as-cast microstructure and tensile properties. Increases of manganese at any level of silicon increased the ratio of pearlite to ferrite, raised the yield strength, and lowered ductility. The mechanical property requirements for Classes 3, 4, and 5 of nodular iron Specification MIL-I-11466 were obtained in the as-cast condition. As-cast ductility was severely impaired when additive silicon-manganese totals exceeded 4.0%. (Author)

NUCLEAR PHYSICS AND NUCLEAR CHEMISTRY

Aerojet-General Nucleonics, San Ramon, Calif.
STANDARDIZATION OF FABRICATION TECHNIQUES (THRESHOLD FOILS) by I. E. Lamb and R. R. Tsukimura. Rept. for Jan 58-22 Sep 59 on Nuclear Instrumentation, Contract AF 33(600)35917. May 60, 101p. 4 refs. WADC Technical rept. 59-607.
Order from OTS $2.50 PB 161 982

The techniques used to develop and standardize a series of neutron detection foils for measurement of neutron spectra are described. The series includes gold and cobalt foils, and plutonium-239, uranium-238, and sulfur threshold foils. A method of calibrating the foils with a low-flux research reactor is discussed. The instrumentation required to obtain data from the foils is presented, together with the neutron intensities that may be explored with these detectors. (Author)

Chicago U., Ill.
RADIOLYSIS OF METHANOL ADSORBED IN SYNTHETIC ZEOLITE-ENERGY TRANSFER EFFECTS, by Weldon G. Brown and Helen E. Krizek. Rept. for Aug-Dec 59 on Contract AF 33(616)3875. June 60, 16p. 10 refs. WADD Technical note 60-28.
Order from OTS $0.50 PB 161 953

Samples of Linde Type 5A Synthetic Zeolite, containing methanol at loadings from 2 to 23%, have been subjected to Co-60 gamma irradiation. Analytical data are given for the major products, hydrogen, formaldehyde and ethylene glycol. The data from these experiments, which were of a preliminary nature, are not sufficiently reliable to establish a significant difference with respect to product distribution as compared with the radiolysis of pure methanol. The yields indicate that a substantial fraction of the increase in total energy absorption due to the zeolite is utilized in product formation. The results, with respect to effect of adsorbent on yields, are generally similar to those previously reported by Caffrey and Allen for pentane on silica gel. Under the assumption that similar mechanisms operate with efficiencies comparable with the liquid state, estimates can be made of the energy transfer efficiency. These range from 10 to 65% over the range of methanol concentrations employed and are approximately linear with respect to methanol concentration up to saturation. Reference is made to some potential practical applications of the energy transfer effect. (Author)

Palmer Physical Lab., Princeton U., N. J.
COMPARISON OF THE STRANGE PARTICLE PRODUCTION IN CLOUD CHAMBERS WITH THE OBSERVATIONS OF DECAY γ-RAYS NEAR INTERNAL COSMOTRON TARGETS, by Theodore Bowen. Technical rept. no. 24 on Cosmic Ray and Elementary Particle Group, Contract Nonr-1858(06). 25 June 59, 33p. 11 refs. AD-217 593.
Order from LC mi$3.00, ph$6.30 PB 147 610

A detailed comparison is presented of strange particle production in cloud chambers with the observations of

decay γ-rays near internal cosmotron targets. The γ-rays were counted in a known geometry; the threshold of the γ counter was low enough (~10 Mev) so that the detection efficiency was essentially constant independent of γ-ray energy. For each of the 35 A^o's and 20 Θ_1^o's observed in the cloud chambers, the probability of counting a γ-ray was calculated for several target-to-occulter distances. Since the cloud chamber events were also used to determine production cross-sections, the total path length of material traversed by protons was determined for each plate material. The absolute comparison of numbers of γ-counts from C, Fe (Cu) and Pb, and the relative comparison of the shapes of the decay curves support a consistent interpretation, making use of currently accepted values of lifetimes and decay branching ratios. Since the production angular distributions and the γ-counts vs distance decay curves are very similar for A^o's and Θ_1^o's, the γ-counting results cannot directly reveal the relative contributions from A^o's and Θ_1^o's. The low upper limits on total production cross sections for strange particles from p-p collisions, in combination with the high K^+ yields observed by others, seem to indicate that the matrix element is not constant, but favors K mesons with low cms momentum.

Elementary Particles

Faculté des Sciences, Orsay (France).
A MODEL FOR THE CALCULATION OF THE OPTICAL POTENTIAL IN SOME FINITE NUCLEI, by B. Jancovici. Technical note no. 20 on Contract AF 61(052)173. [1960] 27p. 13 refs. AFOSR-TN-60-941.
Order from LC mi$2.70, ph$4.80 PB 150 352

The imaginary part of the optical potential is computed in second order in an harmonic oscillator shell model for He^4, O^{16}, Ca^{40}; finite nucleus shell model wave functions are consistently used. The results show a good agreement with those of the Thomas-Fermi approximation, providing a check for the validity of the latter. A stronger absorption in the surface is predicted; this effect is therefore not a spurious effect of the Thomas-Fermi approximation. (Author)

Johns Hopkins U., Baltimore, Md.
THE MASS OF THE SIGMA-PLUS HYPERON, by H. F. Perry and A. Pevsner. Rept. on Contract AF 18(603)143. June 60, 17p. 7 refs. AFOSR-TN-60-530; AD-239 905.
Order from LC mi$2.40, ph$3.30 PB 149 358

The stars produced by K-minus mesons stopping in nuclear emulsion were investigated to find examples of the decay at rest of $\Sigma^+ \rightarrow p + \pi^o$. Fourteen examples of this decay were obtained. The mean weighted range of the proton, corrected to the range in emulsion of standard density, is 1676.3 ± 7.7 microns. This corresponds to a kinetic energy of 18.85 Mev. The mass of the Sigma-plus hyperon was found to be 1189.41 ± 0.54 Mev. (Author)

Maryland U., College Park.
CAPTURE OF K -MESONS FROM HIGH S-ORBITALS IN HELIUM, by T. B. Day and G. A. Snow. Rept. on Contract AF 49(638)24. June 60, 8p. 17 refs. Physics Dept. Technical rept. no. 181; [AFOSR] TN-60-761.
Order from LC mi$1.80, ph$1.80 PB 149 331

Maryland U., College Park.
K-MESON CAPTURE BY HELIUM, by T. B. Day. Rept. on Contract AF 49(638)24. July 60, 26p. 25 refs. Dept. of Physics Technical rept. no. 183; [AFOSR] TN-60-819.
Order from LC mi$2.70, ph$4.80 PB 150 106

Some atomic and molecular processes which occur when K^--mesons stop and are captured in liquid helium are investigated. It is shown that while the K^--meson is in its initially highly-excited atomic states, S-state capture is predominant. (Author)

Maryland U., College Park.
(Σ^o, Λ^o) RELATIVE PARITY AND THE DALITZ DECAY OF THE Σ^o HYPERON, by J. Sucher and G. A. Snow. Rept on Contract AF 49(638)24. July 60, 7p. 5 refs. Dept of Physics Technical rept. no. 188; [AFOSR] TN-60-853.
Order from LC mi$1.80, ph$1.80 PB 150 110

Stanford Research Inst., Menlo Park, Calif.
RESEARCH ON COLLISION PROCESSES OF ELECTRONS AND ATOMS, by James R. Peterson, Otto Heinz, and Charles J. Cook. Annual rept. on Contract Nonr-2588(00). 31 July 59, 43p. 17 refs. SRI Project no. SU-2557; AD-226 525.
Order from LC mi$3.30, ph$7.80 PB 149 727

An apparatus for use in experimental studies of low-energy particle impact phenomena is described: investigation of collisions between electrons and ionized or neutral atoms or molecules will employ crossed-beam techniques, using modulated beams and phase-sensitive detection. The approach represents a departure from conventional atomic beam methods in that the atoms are obtained from a fast ion beam rather than from a thermal source. An analysis of the application of the method to the determination of electron-atom ionization cross sections demonstrates the feasibility of the method. (Author)

Instruments and Installations

Airborne Instruments Lab. [Mineola, N. Y.]
MICROWAVE GAMMA-RAY ION CHAMBER, by Conald A. Brown, Karl A. Speh, and Jesse J. Taub. Rept. for May 58-Nov 59 on Materials Analysis and Evaluation Techniques, Contract AF 33(616)5758. May 60, 70p. 7 refs. WADD Technical rept. 60-98.
Order from OTS $1.75 PB 161 986

A microwave gamma-ray ion chamber and its associated equipment has been developed that is capable of measuring gamma radiation in the range from 10^6 to 10^{10} ergs per gm-hr (carbon). This equipment operates at a microwave frequency of about 9 kmc and

measures radiation by using the changes in the reflection coefficient looking into a gas-filled microwave resonant cavity caused by ionization of the gas due to radiation. Data on gas conductivity and resonant frequency shift have been taken for different gas mixtures (Author).

Frankford Arsenal, Philadelphia, Pa.
A VARIABLE SENSITIVITY GAS THERMOMETER FOR USE AT LOW TEMPERATURES, by F. Rothwarf and J. Steinberg. Sep 59, 13p. 7 refs. Memo. rept. no. M60-1-7; AD-229 586.
Order from LC mi$2.40, ph$3.30 PB 150 306

A variable sensitivity gas thermometer is described which is designed for use in low temperature experiments in the difficult region between liquid helium and room temperatures. The device makes use of the high sensitivity, dP/dT, that can be achieved by having the volume of gas which remains at room temperature considerably larger than that of the thermometer bulb proper. The theoretical analysis is presented, from which design criteria are obtained for various sensitivities and temperature ranges. It is further shown that higher sensitivities can be achieved for a given thermometer by charging the system with the bulb at low temperatures while the dead space is kept at room temperature. Corrections for the various errors that arise in constant volume gas thermometers are discussed. It is found that by increasing the dead space as the temperature is lowered, a fairly constant accuracy can be maintained over the range from 300^{o} K to 4.2^{o} K. (Author).

Lockheed Aircraft Corp., Sunnyvale, Calif.
FEASIBILITY OF A RADIATION DETECTION SYSTEM FOR SPACE TRAVEL. Rept. on Contract AF 29(600)2049. July 60, 50p. 17 refs. LMSD-703014; AFMDC-TR-60-15.
Order from LC mi$3.30, ph$7.80 PB 150 050

Preliminary design criteria are presented for a system of instruments for the measurement of the species, intensities, and energies of space radiation which may be expected on the basis of current understanding of radiation phenomena in space.

Naval Civil Engineering Lab., Port Hueneme, Calif.
RADIATION SLIDE RULE FOR ATOMIC FALLOUT PROBLEMS, by J. C. LeDoux. Final rept. 24 May 60, 24p. 5 refs. Technical rept. 083.
Order from LC mi$2.70, ph$4.80 PB 148 660

The theory, construction, and use of a circular slide rule is presented. It is designed to solve passive-defense residual-radiation problems. The rule is based on the $t^{-1.2}$ law of radioactive decay and can solve an infinite number of problems without recourse to tables, construction, or graphic plots. Several typical problems are worked with the slide rule to demonstrate it. (Author)

Nuclear Engineering and Power

Alco Products, Inc., Schenectady, N. Y.
HAZARDS AND MISSILE SURVEY OF NUCLEAR REACTOR VAPOR CONTAINMENT FOR SM-2, by H. F. Van Kessel. Rept. on Contract DA 44-009-eng-3506. [1958] 172p. 548 refs. APAE no. 45.
Order from LC mi$8.10, ph$27.30 PB 150 551

This report released for sale to the public 11 Oct 60.

Behavioral Sciences Lab., Wright Air Development Div., Wright-Patterson AFB, Ohio.
TASK PERFORMANCE WITH THE CRL MODEL 8 MASTER-SLAVE MANIPULATOR AS A FUNCTION OF OBJECT SIZE, ANGLE, AND HEIGHT OF DISPLAY, by D. Frederick Baker. Rept. on Human Factors in Advanced Flight. May 60, 20p. 13 refs. WADD Technical rept. 60-167.
Order from OTS $0.50 PB 171 013

This experiment was undertaken to investigate criteria for design of equipment to be handled and tasks to be performed with remote-handling equipment. Three variables in remote-handling task performance were studied: size of object handled, height, and angle of display. A CRL Model 8 Master-Slave Manipulator was used for a performance task in which subjects removed three sizes of hexagonal nuts from a display panel presented at three different heights and five different angles. Task performance times were analyzed in relation to joint range limitations of shoulder, elbow, forearm and wrist movements. Within the limits of this study, the size of the object to be handled remotely has little effect on performance. Change in angle of display brings about significant differences in performance time. Performance time tends to improve as angle moves from horizontal to vertical at the upper height; and from vertical to horizontal at the lower height. (Author)

Johns Hopkins U., Baltimore, Md.
A DETERMINATION OF BACKGROUND RADIATION AND THE EFFECT OF SHIELDING, by H. F. Perry and A. Pevsner. Rept. on Contract AF 18(603)143. June 60, 12p. 3 refs. AFOSR-TN-60-548.
Order from LC mi$2.40, ph$3.30 PB 149 360

An investigation of the background radiation, in particular that due to "slow electrons," was undertaken to determine the rate of contamination of undeveloped nuclear emulsions. Unshielded emulsions were found to pick up 4×10^{5} tracks/cm^{3}/day in the 35-200 kev energy range. In a specially constructed iron safe the background was reduced and emulsions picked up only $.09 \times 10^{5}$ tracks/cm^{3}/day. Under the shielded conditions, the latent images faded at a faster rate than the background was acquired. (Author)

Martin Co. [Baltimore, Md.]
A BORON DETERMINATION FOR THE APPR-1. Rept. on Contract DA 44-009-eng-3318. 25 May 59, 37p. MND-E-1718-1; AD-217 691.
Order from LC mi$3.00, ph$6.30 PB 150 550

This report released for sale to the public 13 Oct 60.

An investigation was made of the problem of B loss determination resulting from the fabrication of stainless steel - UO_2 dispersion-type fuel elements for the Army Packaged Power Reactor (APPR-1) in which B is employed as a burnable poison. Comparisons were made between the results of analyses of fuel elements by the Martin Company, Oak Ridge National Laboratory, and the Lucius Pitkin Company. Radiographs showed no detectable reactivity difference between two sets of APPR-1 fuel plates which were fabricated at ORNL. Based on reactivity measurements and compared with the Martin APPR-1 mockup, the amount of B in an average 18-plate APPR-1 element composed of ORNL plates is 71% of the design amount for a B loss of 29%. Chemical analysis of fabricated fuel plates by ORNL and Martin Nuclear showed an average B loss per plate of 22.4% for 100% design B loading or 25.9% for 103.5% of design B loading.

Nuclear Reactions

Institute of Mathematical Sciences, New York U., N. Y.
UPPER BOUNDS ON ELECTRON-ATOMIC HYDROGEN SCATTERING LENGTHS, by Leonard Rosenberg, Larry Spruch, and Thomas F. O'Malley. Rept. on Contracts AF 19(604)4555 and DA 30-069-ORD-2581. Feb 60, 27p. 65 refs. Research rept. no. CX-46; AFCRC-TN-60-249; AD-235 367.
Order from LC mi$2.70, ph$4.80 PB 148 986

Recently developed variational techniques for determining upper bounds on scattering lengths are applied to singlet and triplet scattering of zero energy electrons by atomic hydrogen. The results obtained are not only rigorous but are in fact somewhat lower and therefore somewhat better than those previously obtained by variational methods.

Sarah Mellon Scaife Radiation Lab., U. of Pittsburgh Pa.
ANGULAR CORRELATION STUDY OF THE Mg^{24} (d, p γ)Mg^{25} STRIPPING REACTION AS A TEST OF THE DISTORTED WAVE THEORY, by Joseph Pourcher Martin. Doctoral thesis. Technical rept. no. 1 on Precision Scattering of Nuclear Particles, Contract Nonr-624(10). Oct 59, 66p. 27 refs. AD-227 922.
Order from LC mi$3.90, ph$10.80 PB 149 936

Angular correlations between protons from the Mg^{24}(d, p)Mg^{25} reaction leading to the 3.40 Mev excited state of Mg^{25} and the resulting de-excitation gamma rays were investigated to test the validity of the distorted wave stripping theory. A natural magnesium target was bombarded by 15 Mev deuterons and proton-gamma coincidences were counted using scintillation detectors in conjunction with conventional fast-slow coincidence circuitry. The correlations were studied at laboratory proton scattering angles of 15^o and 45^o, each in two mutually perpendicular planes: the reaction plane and the plane perpendicular to it containing the deuteron axis. The angular distribution of protons from the same level was measured and fitted by a Butler stripping curve with $l_n = 1$ and $r_o = 5.0$ fermis. (Author)

Vienna U. (Austria).
THE TWO-BODY PROBLEM IN THE EXTREME RELATIVISTIC LIMIT, by W. Thirring and K. Baumann. Scientific note no. 5 on Contract AF 61(052)265. 10 June 60, 9p. 14 refs. AFOSR-TN-60-942.
Order from LC mi$1.80, ph$1.80 PB 150 353

Radioactivity

Army Engineer Research and Development Labs., Fort Belvoir, Va.
A STUDY OF THE ENGINEERING ASPECTS OF EXPEDIENT GAMMA-SHIELDING MATERIALS, by Cluey D. Hargrove and Allen F. Grum. Rept. for 1 Feb-1 June 59. 7 Apr 60, 69p. 6 refs. Technical rept. 1622-TR. AD-238 440.
Order from LC mi$3.90, ph$10.80 PB 149 317

The purposes of the tests covered in this report were (1) to determine attenuation (absorption) coefficients and (2) to determine dose rates as a function of shield thickness for 10 shielding materials that can be found in the field, such as water, rock, dirt, or wood. Measurements were made with a sodium iodide, thallium-activated crystal and a 128-channel pulse height analyzer. Point sources were used for the attenuation coefficient measurements and 12-inch-diameter uniformly distributed sources for the dose rate measurements. The report concludes that: (a) It is uneconomical to try for a "good" gradation of rock when using rock as an expedient shield be-because the differences in density between a good and poor gradation in most cases would be only 10 to 20 percent. In rare cases where the good gradation has a density appreciably greater than the poor gradation, it would be worthwhile to achieve a good gradation, (b) any effort spent on compacting soil in an expedient shield would be effort well spent; (c) sand should be used in its driest natural state for effective gamma attenuation; and (d) the curves as presented by WKNL may be unconservative for some applications. (Author)

Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.
THE DISINTEGRATION OF Ba^{131}, by J. Richard Haskins. 1 Aug 59, 44p. 21 refs. ARGMA TR-1C32R; AD-220 888.
Order from LC mi$3.30, ph$7.80 PB 149 094

The energies of the high energy gamma rays in the decay of Ba^{131} were measured and found to be: 810 ± 10, 925 ± 10 and 1050 ± 15 Kev. The existence of a 405 Kev. gamma ray in coincidence with the 214 Kev. gamma ray was confirmed. It was determined that there are two gamma rays with energies of approximately 250 Kev., one in coincidence with the 122 Kev. gamma ray and the other in coincidence with the 372 Kev. gamma ray. The 496 Kev. -122 Kev. cascade was investigated. The K conversion coefficient for the 496 Kev. gamma ray was determined to be $(10.5 \pm 1.0) \times 10^{-3}$. The gamma-gamma angular correlation was found to be isotropic with both liquid and metallic barium sources. The K/L conversion ratio for the

122 Kev. gamma ray was determined to be 2.7 ± 0.5. These results are consistent with a 3/2 (M1) 1/2 (E2) 5/2 cascade or a 3/2 (M1 + E2) 5/2 (M1 + E2) 5/2 cascade with certain possible mixing ratios. Additional experiments are proposed, the results of which should make a decision between these two cases possible. (Author)

Army Signal Research and Development Lab., Fort Monmouth, N. J.
PLOTTING SCALE ML-556(XE-1)/UM, by Bruce F. Watson. 1 Aug 59, 26p. 2 refs. USASRDL Technical rept. 2059; AD-226 417.
Order from LC mi$2.70, ph$4.80 PB 147 824

Plotting Scale ML-556(XE-1)/UM is designed to speed and simplify the construction of the fallout wind plot for the Army method of fallout prediction. The fallout wind plot is a configuration through means of which the location of close-in fallout can be predicted by considering the vertical and horizontal velocities of fallout particles. The plotting scale is developed to fulfill the requirement for a convenient method of accounting for the changing rates of descent and horizontal displacements of fallout particles as they move through the atmosphere.

Convair, Fort Worth, Tex.
AIR AND CONCRETE SCATTERING OF GAMMA RAYS, by M. B. Wells. Rept. on Contract AF 33(600)32054. 20 Mar 59, 107p. 13 refs. ANP doc. no. NARF-59-11T; MR-N-229.
Order from LC mi$5.70, ph$16.80 PB 150 674

This report released for sale to the public 12 Oct 60.

This report describes a Monte Carlo method of computing the angular distribution and energy spectrum of gamma rays scattered in air and ground. The development of the integrals representing the contribution of each order of scattering to the total scattered flux, and the application of random sampling methods to the evaluation of these integrals, are outlined in detail. Calculation of the flux arising from pair-production interactions is also described. Results obtained in a parameter study for a source-detector height of 12.5 feet above a concrete slab are presented in both graphical and tabular form for various source energies and separation distances. (Author)

Defense Atomic Support Agency, Washington, D. C.
RADIOACTIVE FALLOUT FROM NUCLEAR EXPLOSIONS, by Edward N. Parker. 1 Aug 60, 32p. DASA-1188.
Order from OTS $1.00 PB 161 970

This report is a non-technical description of Fallout from Nuclear Explosions. The mechanisms of local and world-wide fallout are described. The relative importance of local fallout in a nuclear war is discussed. The effects upon man of world-wide fallout from past nuclear testing is discussed. It is pointed out that doses to man from testing have been quite small when compared to the natural radiation background. (Author)

Diamond Ordnance Fuze Labs., Washington, D. C.
PROBABILITY DISTRIBUTIONS USING A COUNTING SYSTEM WITH A FINITE RESOLVING TIME, by Arthur Hausner. 15 Aug 60, 13p. 3 refs. Technical rept. TR-853.
Order from LC mi$2.40, ph$3.30 PB 149 294

Analysis is made of the probability distributions of a counting system that requires two particles to be separated by a time, τ, for both to be counted. If a radioactive source emits particles that satisfy a Poisson distribution and an average of ν particles per unit time arrive at the counter, then counting for a period, T, results in a non-Poisson distribution of counts as a result of the dead time, τ. The distribution of counts is slightly skewed to the right, but for sufficiently large T, the skewness diminishes and the distribution approaches a normal one. Exact computations with the IBM 704 digital computer are in good agreement with results given.

Illinois U., Urbana.
MÖSSBAUER EFFECT: RECOILLESS EMISSION AND ABSORPTION OF GAMMA RAYS; CONFERENCE HELD JUNE 6-7, 1960, AT UNIVERSITY OF ILLINOIS, by Hans Frauenfelder and Harry Lustig. Rept. on Contract AF 18(603)49. [1960] 79p. 52 refs. [AFOSR] TN-60-698; AD-240 109.
Order from LC mi$4.50, ph$12.30 PB 149 301

Contents: Session I: Theory, isotopes, experimental; Session II: Relativity, nuclear applications, chemical shifts, line width; Session III: Internal fields, impurities, resonance experiments and ultrasonics, Raleigh scattering and Varia.

Institute of Engineering Research, U. of California, Berkeley.
COMPUTED EFFECTS OF THE INTERIOR WALLS OF A HOUSE ON THE GAMMA RADIATION INTENSITY FROM A GROUND SOURCE FIELD, by C. Schlegel. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 14p. 3 refs. Series no. 2, issue no. 10.
Order from LC mi$2.40, ph$3.30 PB 149 920

A point-to-point computation method is used to determine intensity levels and intensity patterns within a test house. The investigations show that interior walls should be considered in a sophisticated determination of intensity level and intensity pattern. (Author)

Institute of Engineering Research, U. of California, Berkeley.
COMPUTED EFFECTS OF THE ROOF PITCH AND THE CEILINGS OF HOUSES ON THE GAMMA RADIATION INTENSITY FROM A ROOF SOURCE FIELD, by C. Schlegel. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 26p. 3 refs. Series no. 2, issue no. 9.
Order from LC mi$2.70, ph$4.80 PB 149 919

A point-to-point computational method for simulating a roof source field is used to study the shielding effects of roofs and ceilings. A method for representing a pitched roof by an equivalent flat roof is developed for one case. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A COMPUTER PROGRAM FOR CALCULATING GAMMA RADIATION INTENSITY, by A. Ruyle. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 14p. Series no. 2, issue no. 7.
Order from LC mi$2.40, ph$3.30 PB 149 917

A program is described which calculates the intensity from a set of isotropic point sources at a set of isotropic point detectors in the presence of a set of parallelepiped shields. A number of optional variations are available. (Author)

Institute of Engineering Research, U. of California, Berkeley.
COMPUTER PROGRAM FOR RANKING VALUES AND DETERMINING PROBABILITY FREQUENCIES OF DOSE AND INTENSITY OBTAINED FROM A MONTE CARLO CALCULATION, by R. C. Grassi. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 37p. Series no. 2, issue no. 3.
Order from LC mi$3.00, ph$6.30 PB 149 913

A program has been developed which will give ranked values of dose after an infinite time and ranked values of intensity one hour following burst for a given location (monitoring point). Each value of dose and/or intensity calculated represents the fallout received from a Monte Carlo iteration. In addition, the program will calculate the number of values of dose and intensity, respectively, for each throw or iteration, which are above a specified level of radiation. The computing procedure uses a modification of a program previously reported for plotting iso-intensity and iso-dose contours resulting from the effects of radioactive fallout. (Author)

Institute of Engineering Research, U. of California, Berkeley.
FALLOUT PREDICTION: A SIMPLIFIED DETERMINISTIC METHOD, by D. C. Kleinecke. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 1 Dec 59, 23p. 5 refs. Series no. 2, issue no. 27.
Order from LC mi$2.70, ph$4.80 PB 149 932

Many deterministic fallout models express the predicted contamination as an integral over an area surrounding the contaminated point. This integral is equivalent to an integral over a region in the fallout cloud. Precalculated scatter diagrams representing the cloud as an array of dots reduce the evaluation of this integral to a simple process. An example is described in detail. (Author)

Institute of Engineering Research, U. of California, Berkeley.
GAMMA RAY ABSORPTION COEFFICIENTS FOR STRUCTURAL MATERIALS, by P. R. Werling. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 50, 8p. 3 refs. Series no. 2, issue no. 8.
Order from LC mi$1.80, ph$1.80 PB 149 918

Linear absorption coefficients for usual structural members are tabulated. The members are assumed to be approximated by homogeneous slabs. (Author)

Institute of Engineering Research, U. of California, Berkeley.
THE INFLUENCE OF A FIRE-INDUCED CONVECTION COLUMN ON RADIOLOGICAL FALLOUT PATTERNS, by A. Broido and A. W. McMasters. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 49p. 10 refs. Series no. 2, issue no. 13.
Order from LC mi$3.30, ph$7.80 PB 149 923

Since no nuclear devices have been detonated by the United States under conditions leading to both mass fires and radiological fallout, a theoretical and small-scale experimental study was undertaken to see if fire-induced convection columns could significantly effect fallout patterns. Experiments were conducted in a 6- by 6-foot low-velocity wind tunnel using full-scale fallout simulants. Values of characteristic parameters of fallout patterns were compared for experiments conducted with and without fire, all other factors being held constant. As predicted by theory, a fire upwind of the region of deposition introduced a further downwind movement and lateral dispersion of the fallout. In a few experiments in which the fire was located at the edge of the no-fire pattern, air flow into the convection column shifted the pattern peak upwind. These results suggest quite strongly that effects which can markedly alter civil defense planning will be found for large-scale fires. Since this effect can be significantly influenced by the air flow into and around the column, open air experiments on a larger scale should be performed so that such flow will not be affected by tunnel walls and ceiling. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A MACHINE PROGRAM FOR PARTICLE POSITION VARIANCES AND COVARIANCES, by C. L. Bisson. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 7 Apr 59, 22p. 3 refs. Series no. 2, issue no. 21.
Order from LC mi$2.70, ph$4.80 PB 149 928

This report gives an IBM 704 digital computer program for calculating the variances and covariances of the coordinates of the positions of fallout particles or discs of fallout particles when they reach the ground. (Author)

Institute of Engineering Research, U. of California, Berkeley.
ON EVALUATING CERTAIN INTEGRALS APPEARING IN THE PROBABILISTIC MODEL DESCRIBING THE RADIATION INTENSITIES OF FALLOUT, by A. Grasselli. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 13p. 2 refs. Series no 2, issue no. 11.
Order from LC mi$2.40, ph$3.30 PB 149 921

This report describes in detail the method of computation of certain integrals that appear in the mathematical model of radiation intensities of fallout from a nuclear detonation.

Institute of Engineering Research, U. of California, Berkeley.
AN EXTRAPOLATION FROM FISSION PRODUCT SPECTRA TO FALLOUT SPECTRA, by I. R. Jones. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 1 June 59, 15p. 7 refs. Series no. 2, issue no. 23.
Order from LC mi$2.40, ph$3.30 PB 149 929

Using unclassified sources of information an estimate is made of the neutron-induced gamma ray activity accompanying fission. This is combined with available information on the gamma ray activity of fission products to provide an estimate of the gamma ray spectra of fallout. (Author)

Institute of Engineering Research, U. of California, Berkeley.
GAMMA SHIELDING EXPERIMENTS, by D. Doughty, I. Jones and H. Shaked. Progress rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 21p. Series no. 2, issue no. 6.
Order from LC mi$2.70, ph$4.80 PB 149 916

A series of preliminary experiments have been performed to determine the lateral extent of a shield which is equivalent to a shield of infinite lateral extent. (Author)

Institute of Engineering Research, U. of California, Berkeley.
PARTICLE FALL RATE CALCULATION, by M. L. Katz and R. R. Read. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 15 Apr 59, 17p. 12 refs. Series no. 2, issue no. 12.
Order from LC mi$2.40, ph$3.30 PB 149 922

An examination is made of the present methods of calculating fall rates for irregularly shaped particles and it is pointed out that the present methods are not reliable. Brief mention is made of planned experimental work to rectify this situation. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A PROBABILISTIC BASIS FOR DESCRIBING THE RADIATION INTENSITIES OF FALLOUT, by Robert R. Read and Ronald W. Shepherd. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 7 Apr 59, 55p. 16 refs. Series no. 2, issue no. 20.
Order from LC mi$3.60, ph$9.30 PB 149 927

The report contains the application of statistical regression techniques to the problem of finding minimum variance linear estimators for positions of deposited fallout particles given some meteorological information in the form of hodographs. It is indicated how these methods can be integrated with stabilized cloud models to obtain probabilistic fallout models. The mathematical problems that arise when converting particle position estimators into radiation intensity estimators are exhibited for purposes of presenting the meanings of certain simplifying assumptions that are often made. Methods for calculating variances and covariances of radiation intensity residuals from the estimated values are presented. A formula for the joint probability density function of distances of deposited cloud slice centers from a particular point is derived, under the assumption that wind velocities form a Gaussian process. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A PROGRAM FOR COMPUTING RADIATION FLUX FROM A UNIFORM FIELD, by H. L. Dachslager. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 5p. Series no. 2, issue no. 4.
Order from LC mi$1.80, ph$1.80 PB 149 914

A program is described which computes the radiation flux from an infinite uniform plane contaminated outside a circle. A number of cases can be handled simultaneously. (Author)

Institute of Engineering Research, U. of California, Berkeley.
THE SAMPLE SURVEY OF SHELTER AREAS, by D. W. Barker and D. J. Sundblom. Progress rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 41p. 12 refs. Series no. 2, issue no. 15.
Order from LC mi$3.30, ph$7.80 PB 149 925

A pilot study for the proposed sample survey has been completed. Before the survey is completed it will be necessary to obtain engineering approximations to structural characteristics and to revise the statistical design. An appendix discusses the statistical problem in detail. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A SIMPLIFIED TIME-DEPENDENT GAMMA-RAY SPECTRUM FOR FALLOUT, by D. J. Doughty and D. C. Kleinecke. Rept. on Civil Defense Research Project, Contract CR-SR-58-40. 15 Aug 59, 26p. 7 refs. Series no. 2, issue no. 26.
Order from LC mi$2.70, ph$4.80 PB 149 931

The gamma radiation emitted by fallout is a mixture of hundreds of different photon energies whose relative importance changes through time. It is desirable to approximate this spectrum by a simpler spectrum involving fewer photon energies. A simplified spectrum with four photon energies, which closely approximates more detailed spectra, is proposed and illustrated. (Author)

Institute of Engineering Research, U. of California, Berkeley.
STABLE CLOUD MODELS FOR FALLOUT PREDICTION, by M. L. Katz and D. C. Kleinecke. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 15 Feb 59, 20p. 8 refs. Series no. 2, issue no. 18.
Order from LC mi$2.40, ph$3.30 PB 149 926

This report presents the most general formulation of stable cloud models. It is shown how to specialize this general formulation to obtain a version of the cloud which can be used in studying actual events. (Author)

Institute of Engineering Research, U. of California, Berkeley.
A STATISTICAL APPROACH TO A SURVEY OF FALLOUT SHELTER AREAS IN CONTRA COSTA COUNTY, by D. J. Sundblom. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 2 Feb 59, 9p. Series no. 2, issue no. 5.
Order from LC mi$1.80, ph$1.80 PB 149 915

A possible sampling survey of shelter areas in Contra Costa County is described. The same methods might be used to check the proposed OCDM survey. (Author)

Institute of Engineering Research, U. of California, Berkeley.
SUMMARY OF PROBLEMS RELATING TO LOCAL FALLOUT CONTAMINATION OF WATER SUPPLIES, by M. B. Hawkins. Progress rept. on Civil Defense Research Project, Contract CD-SR-58-40. 24 Feb 59, 73p. 67 refs. Series no. 2, issue no. 14.
Order from LC mi$4.50, ph$12.30 PB 149 924

Institute of Engineering Research, U. of California, Berkeley.
VERTICAL AIR FLOW AND FALLOUT, by Arnold Court. Rept. on Civil Defense Research Project, Contract CD-SR-58-40. 1 June 60, 13p. 17 refs. Series no. 2, issue no. 29.
Order from LC mi$2.40, ph$3.30 PB 149 933

Techniques for the prediction of radiological fallout patterns usually ignore the effects of the vertical component of winds. The purpose of this study is to determine the magnitude of such vertical motions and estimate the consequences of neglecting them in civil defense problems. Using data computed daily by the Joint Numerical Weather Prediction Unit of the National Meteorological Center, this study has determined that the monthly average of the vertical air movement at 600 mb (in the middle of the troposphere) is about 0.5 cm/sec over continental areas of the Northern Hemisphere; the standard deviation is roughly the same magnitude. Averages computed separately for the 00 and 12 GMT observations show good agreement in the various months, and change slowly from month to month during the six months, December 1958 through May 1959, that are analyzed. The analysis tends to support the assumption that average vertical wind motions as described by the available data may be neglected for civil defense purposes. (Author)

Naval Radiological Defense Lab., San Francisco, Calif.
THE CONDENSATION OF RUBIDIUM VAPOR ONTO HOT OXIDE SURFACES, by C. E. Adams. 7 Aug 59, 31p. 26 refs. Research and development technical rept. USNRDL-TR-355; AD-226 430.
Order from LC mi$3.00, ph$6.30 PB 150 303

By use of an atomic beam technique, an investigation was made of the condensability of vaporized rubidium in a slightly oxidizing atmosphere upon the surfaces of different oxides at varying temperatures. It was found that rubidium vapor was effectively condensed at high temperatures upon oxides with which rubidium oxide could form thermally stable complex compounds. Rubidium vapor was not condensed at high temperatures upon oxides with which rubidium oxide does not form stable complex compounds. A method of predicting the relative tendency for rubidium oxide to form complexes with a series of different oxides was devised. (Author).

Naval Radiological Defense Lab., San Francisco, Calif.
DIATOMITE FILTER, TEST TO DETERMINE FEASIBILITY OF USE IN REMOVING Y^{91} FROM FRESH WATER, by M. M. Bigger and A. J. Hodges, Jr. Memo. rept. 17 Aug 50, declassified 10p. AD-229(OE).
Order from LC mi$1.80, ph$1.80 PB 149 982

The test indicates that flocculation may be expected to remove Y^{91} or similar fission products from fresh water with a factor of approximately 100. Diatomite filtration was less effective, with a factor of approximately 8. The flocculation results are in agreement with small-scale laboratory tests.

Naval Research Lab., Washington, D. C.
ATMOSPHERIC RADIOACTIVITY IN SOUTH AMERICA AND ANTARCTICA, by L. B. Lockhart, Jr. 15 Aug 60, 10p. 8 refs. NRL rept. 5526.
Order from LC mi$1.80, ph$1.80 PB 148 664

Information on the concentration of the major natural radioactive species and of gross fission product β activity in the ground-level air at several sites in South America and Antarctica is reported. These data have been obtained through a cooperative program between the U. S. Naval Research Laboratory and groups at the various collecting sites utilizing equipment designed and supplied by NRL. Fission products have been found to be a minor contributor to the radioactivity of the air in the Southern Hemisphere except that in the antarctic region (and presumably at some island sites) it assumes relatively more importance because of the low concentrations of natural activity there. Seasonal variations in one or more of the radioactive components of the atmosphere are evident at each of the various sites. (Author)

Naval Research Lab., Washington, D. C.
FISSION PRODUCT RADIOACTIVITY IN THE AIR ALONG THE 80th MERIDIAN (WEST) DURING 1959, by L. B. Lockhart, Jr., R. L. Patterson, Jr. and others. 15 Aug 60, 19p. 11 refs. NRL rept. 5528.
Order from LC mi$2.40, ph$3.30 PB 148 665

The program of measurement of the fission product concentration in the air at ground level at sites along the 80th meridian was continued during 1959. During this period no fresh nuclear debris was added to the atmosphere, with the result that seasonal changes in deposition rates from stratospheric sources were more apparent. The radioactivity levels in the Northern Hemisphere reached the highest average during the operation of this network (started May 1956) in the spring of 1959. Radiochemical analyses indicated that the bulk of this debris was introduced into the stratosphere during the October 1958 series of high-yield nuclear tests held in the arctic region of the Soviet Union. There has been obtained evidence of a definite seasonal dependence for

stratospheric deposition with debris in the arctic stratosphere being more strongly influenced than that in the tropic stratosphere. No such definite conclusions can be made from radioactivity collected in the Southern Hemisphere. Evidence indicates that mixing of the stratospheric sources in the Northern Hemisphere was not complete by the end of 1959; and though radioactivity levels in the two hemispheres were approaching unity during the fall of 1959, the isotopic composition of the collections indicated the average age of the debris in the Southern Hemisphere to be much greater. (Author)

North Carolina State Coll., Raleigh.
THEORETICAL EVALUATION OF THE VARIANCE FOR THE STATISTICAL CORRELATION METHOD FOR MEASURING DAUGHTER HALF-LIVES IN THE 10^{-4} - 10^{-1} SECOND RANGE, PART I, by Robert P. Kennel (Master's thesis) Wesley O. Doggett, and Linus K. Han. Technical rept. no. 2 on Contract DA 01-009-ORD-820. July 60, 75p. 8 refs. OOR rept. no. 2543.2-P.
Order from LC mi$4.50, ph$12.30 PB 150 401

A time correlation method proposed by Petroff and Doggett ("Application of a statistical correlation function for determining daughter half-lives in the range 10^{-1} - 10^{-4} second." Rev. Sci. Instr., Vol. 27, No. 10, 838, October, 1956.) for investigating two connected nuclear disintegrations was studied. The method permits determination of half-lives in the 10^{-4} - 10^{-1} second range for daughters in equilibrium with long lived parents without the count rate restrictions imposed on the usual delayed coincidence method by the occurrence of accidental coincidences. The variance and fractional standard deviation of the correlation measurement are theoretically evaluated for a radioactive source cascade with negligible background and constant source strength, and the variance is determined for background activity with no cascade present. (Author)

Space Tech. Labs., Inc., Los Angeles, Calif.
EFFECTS OF NUCLEAR RADIATION ON SOME COMMON MATERIALS AND ELECTRONICS COMPONENTS, by Newell Hart Smith. 4 Feb 58, 27p. 18 refs. Rept. GM-TR-0165-00358.
Order from LC mi$2.70, ph$4.80 PB 148 960

This report has been written to provide guidance for those doing preliminary design of equipment to be exposed to nuclear radiation. It is based upon a review of many of the documents from the extensive literature on radiation damage, and presents information from the literature concerning radiation damage to a few common materials and to typical electronic equipment. In addition, an example illustrating the way in which this information may be useful for space vehicle design is also given.

PERSONNEL SUPPLIES AND PERSONAL EQUIPMENT

Aerospace Medical Div., Wright Air Development Div., Wright-Patterson AFB, Ohio.
EFFECTIVE DEAD SPACE IN THE MA-3 HELMET, by Elizabeth Comfort. Rept. on Pressure Suits and Accessories. May 60, 8p. 3 refs. WADD Technical rept. 60-362.
Order from OTS $0.50 PB 171 018

The respiratory response of a group of subjects wearing the MA-3 full-head helmet was compared with the response to known dead space volumes. Comparison of these data showed that the average effective dead space or volume of rebreathed air was approximately 235 cc. when the MA-3 helmet was supplied with oxygen at 3 to 4 inches of water positive pressure from a standard pressure suit regulator. The concentration of inspired CO_2 was calculated to be 0.8 percent. (Author)

Quartermaster Research and Engineering Center, Natick, Mass.
VENTILATION OF INSULATED BOOTS, by A. H. Woodcock and R. L. Pratt. June 60, 10p.. 1 ref. Technical rept. EP-135.
Order from LC mi$1.80, ph$1.80 PB 150 119

An investigation has been made of the quantity of air which must be pumped into the insulated boot to evaporate the sweat secreted by the foot in a warm environment. At an ambient temperature of 80°F an unventilated boot accumulated approximately 44 gm of sweat in 2 hours. In a ventilated boot, ventilation rates as high as 20 liters per minute failed to evaporate this moisture and left an accumulation of at least 10 gm of sweat within the boot. Complete change of air within the boot at each step at normal walking rate would produce a ventilation rate of considerably less than 20 liters per minute. At a lower ambient temperature (67°F) sweat secretion was somewhat less, but the cooler ambient air which was supplied was less efficient in removing moisture, so that the net accumulation was almost the same as at the higher temperature. (Author)

PHYSICS

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
CURRENT INDUCED SWITCHING OF SUPERCONDUCTIVE THIN FILMS, by Frederick W. Schmidlin and Arthur J. Learn. Eugene C. Crittenden, Jr. and John N. Cooper (Naval Postgraduate School).
15 June 60, 30p. 4 refs. STL/TR-60-0000-NR165.
Order from LC mi$2.40, ph$3.30 PB 150 042

Currents required to cause superconducting to normal transitions of thin films have been measured as a function of temperature for various widths and thicknesses. Normal to superconducting transition times for the same films have also been measured as a function of the magnitude of drive current. In spite of the lack of a satisfactory theoretical model for the initiation of the transition, the bulk of the results can

be understood in terms of temperature changes in the film, as governed by factors limiting the flow of heat (generated subsequent to the initial transition) into the substrate and liquid helium bath. (Author)

Acoustics

Anti-Submarine Warfare Lab., Naval Air Development Center, Johnsville, Pa.
INSTRUMENTATION AND TECHNIQUES FOR AIRCRAFT USE IN ACOUSTIC RESEARCH AND IN OCEANOGRAPHIC SURVEYS, by J. J. Coop. Technical note. 28 July 59, 19p. Rept. no. NADC-AW-N5914.
Order from LC mi$2.40, ph$3.30 PB 149 158

Since 70 percent of the earth's surface is covered with water, neither the sonar conditions nor their variations with time are known in most areas of the world. The seasonal trend is known in many areas, but because of meteorological factors and ocean currents prediction of the sonar conditions for a given day are often inaccurate. It is proposed that by use of aircraft the acoustic condition over large areas, commensurate with meteorological factors such as storms, should and could be measured before, during, and after the passage of such storms to correlate cause and effect.

Princeton U., N. J.
EFFECT OF TRANSPORT PROCESSES ON ATTENUATION AND DISPERSION IN AEROSOLS, by S. L. Soo. Rept. on Project Squid, Contract Nonr-1858(25). Oct 59, 15p. 8 refs. Technical rept. PR-100-P; AD-229 222.
Order from LC mi$2.40, ph$3.30 PB 149 494

Rome Air Development Center, Griffiss, AFB, N. Y.
THE EFFECTS OF INTERFERENCE ON SPEECH COMMUNICATION, by George E. Renaud. June 60, 19p. 14 refs. RADC-TN-60-104.
Order from LC mi$2.40, ph$3.30 PB 149 973

This report was written in an attempt to tie together many of the data which pertain to the ability of the operator to derive intelligence from a speech signal when this signal has been altered by processes which occur or could occur in a communication link. No attempt has been made to present a complete summary of all the data in existence in this area. The accent has been on the auditory response of the operator. There were two major purposes in writing this report. The first was to indicate that it is not necessary to build a hi-fi system when the purpose is to transmit information by means of voice. The second is to indicate the lower limits of system performance which can be tolerated and still operate with some degree of efficiency. In other words, the design and subsequent successful operation of any voice communication system can be made easier when the operator is considered as a functional operating link (subsystem) in the system. (Author)

Rome Air Development Center, Griffiss AFB, N. Y.
THE EFFECT OF SPEECH AND NOISE LEVEL ON THE MASKING OF SPEECH BY PURE TONES AND RANDOM NOISE, by R. J. Christman, George E. Renaud, and Arthur Rubin. June 60, 24p. 7 refs. RADC TN-60-97.
Order from LC mi$2.70, ph$4.80 PB 149 972

This report describes an experiment on the masking of speech with random noise and pure tones. Harvard PB-50 word lists were used as test material, with masking signals of 100, 175, 250, 350, 500, 700, and 1000 cycles per second and random noise. Speech levels at the ear, ranging from 45 to 115 db and noise from 75 to 120 db (all re 0.0002 dynes/cm^2), were used. Data are presented in the form of curves, illustrating the relationship among the parameters: speech level, interference level, and frequency of interference (for the pure tone masking). It is shown, in general, that masking with random noise is some 30 db superior to masking with pure tones. It is further shown that for low levels of intelligibility pure tone masking is greatest with tones in the 400 to 600 cps range. For intelligibility levels of 85 percent or greater, masking efficiency increases with frequency of the masking tone, at least up to 1000 cps, the highest frequency used in the experiment. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
COMPUTATION OF ACOUSTIC TRANSMISSION THROUGH A PLANE ELASTIC PLATE, by G. B. Thurston and Raya Stern. Rept. on Contract Nonr-1224(24). Oct 59, 24p. 9 refs. 2784-3-T; AD-227 906.
Order from LC mi$2.70, ph$4.80 PB 149 939

Results are presented of a series of computations of the magnitude and phase of the pressure transmitted by a plane wave through a plane plate. The plate is assumed to possess perfect elasticity and to be immersed in a perfect fluid. The procedure for carrying out transmission computations with the equations of H. Reissner is specified. Computations according to the approximate equation of L. Cremer are compared with those of Reissner. Computed results for plates of steel, Lucite, and polyethylene immersed in sea water are presented. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
A METHOD OF DETERMINATION OF THE RADIATED ACOUSTIC FIELD OF A SOURCE TRANSMITTING THROUGH A FINITE PLATE, by George B. Thurston. Rept. on Contract Nonr-1224(24). Oct 59, 33p. 23 refs. 2784-4-T; AD-227 907.
Order from LC mi$3.00, ph$6.30 PB 149 940

A method is given for the determination of the radiated acoustic field of a course transmitting through a finite plate. The method is based on the use of the Helmholtz formula together with appropriate assumptions concerning the part played by a transmitting plate in modifying the transmitted wave. The method involves the use of information on plane-wave transmission properties of infinite plane plates. The procedure is specifically set up for use of high-speed computing equipment in carrying out computations of the radiated field. A numerical example is given of the determination of the acoustic field of a modified spherical source transmitted through a plane circular steel plate immersed in sea water. (Author)

Electricity and Magnetism

Carnegie Inst. of Tech., Pittsburgh, Pa.
THE MAGNETIC SUSCEPTIBILITIES OF SINGLE CRYSTAL $NiCl_2 . 6H_2O$ AND $CoCl_2 . 6H_2O$ AT LOW TEMPERATURES, by R. B. Flippen and S. A. Friedberg. Technical rept. no. 6 on Contract Nonr-760(05). 29 Oct 59, 9p. 6 refs. AD-228 108.
Order from LC mi$1.80, ph$1.80 PB 149 867

The magnetic susceptibilities of single crystal $NiCl_2 . 6H_2O$ and $CoCl_2 . 6H_2O$ were measured down to 1.3°K for various orientations. The occurrence of antiferromagnetism in $CoCl_2 . 6H_2O$ below ~2.3°K is confirmed as is the anisotropy of the g-factor of the Co^{++} ion over the whole range. It is concluded that $NiCl_2 . 6H_2O$ is antiferromagnetic in the helium region and that the temperature-independence of the powder susceptibility here is due to the fact that $\chi_\perp$ rises as T falls below T_N. In both salts the c-axis is apparently the preferred direction of spin alignment in the antiferromagnetic state. (Author)

Geophysical Inst., U. of Alaska, College.
EARTH CURRENT ACTIVITY AT COLLEGE, ALASKA, JULY 1959, by V. P. Hessler. Scientific rept. no. 4 on Contract AF 19(604)3075. 15 June 60, 42p. 11 refs. UAG-R110; AFCRC-TN-60-481.
Order from LC mi$3.30, ph$7.80 PB 149 758

This report presents College N-S earth current records for the month of July 1959. The scale of 1 inch per hour permits detailed scaling directly from the reproductions in the report. Scalings of hourly range in amplitude and rapid fluctuation activity are given. The amplitude scalings are also presented as curves together with average curves for a period of several years to show the relative magnitudes of the July 1959 activity. The earth current always displays much more pronounced fine structure than the corresponding geomagnetic activity. (Author) (See also PB 147 513)

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
FIELD DISPLACEMENT EFFECTS IN DIELECTRIC AND FERRITE LOADED WAVEGUIDES, by T. M. Straus. Doctoral thesis. Technical rept. no. 1, Series 2, on Contract AF 19(604)5487. 25 sep 59, 98p. 35 refs. AFCRC-TN-60-582.
Order from LC mi$5.40, ph$15.30 PB 149 787

The only available calculations concerning propagation in ferrite slab loaded waveguides are those of Lax, Button and Roth which are limited to transverse electric type modes. Due to its imcompleteness the theory leads to certain anomalies which have been the subject of considerable discussion in recent years. It is the purpose of the work herein reported to solve the anomalies dealing with one-way transmission and with the field displacement isolator. This is done largely through experiments which indicate the extent to which the theory is able to predict the actual mode configurations.

Gordon McKay Lab. of Applied Science, Harvard U., Cambridge, Mass.
A SPIN WAVE ANALYSIS OF FERROMAGNETIC RESONANCE RELAXATION, by Charles R. Buffler. Scientific rept. no. 3, Series 2, on Contract AF 19(604)5487. 25 Feb 60, 161p. 161 refs. AFCRC-TN-60-589.
Order from LC mi$7.80, ph$25.80 PB 149 788

The work reported is primarily an investigation of the mechanisms involved in ferromagnetic resonance line width processes in both single crystal and polycrystalline materials. Experimental work has been performed to indicate how the line width is related to the recent theories of ferromagnetic resonance. These experiments have primarily taken the form of line width and g value versus frequency studies. By investigating the behavior of these spectrums, the validity of the various theoretical explanations are indicated.

Institute for Advanced Study, Princeton, N. J.
COMBINATORIAL ASPECTS OF THE ISING MODEL FOR FERROMAGNETISM. I. A CONJECTURE OF FEYNMAN ON PATHS AND GRAPHS, by S. Sherman. Rept. on Contract Nonr-2969(00). Oct 59, 48p. 16 refs.
Order from LC mi$3.30, ph$7.80 PB 149 478

In this paper Feynman's conjectured identity between a function of weighted paths and the desired function of admissible subgraphs is generalized to any reasonable planar graph and shown to be correct.

Materials Research Lab., Watertown Arsenal, Mass.
ANALYSIS OF FERROMAGNETIC AND ANTIFERROMAGNETIC SECOND ORDER TRANSITIONS (ERRATA), by J. A. Hofmann, A. Paskin and others. June 60, 3p. 1 ref. MRL rept. no. 76.
Order from LC mi$1.80, ph$1.80 PB 148 408

Naval Ordnance Lab., White Oak, Md.
NEW FLUX-GATE MAGNETOMETERS FOR USE WITH SINGLE STRIP PERMEAMETERS, by C. Q. Adams. 21 Mar 60, 27p. 3 refs. NAVORD rept. 6835; AD-239 498.
Order from LC mi$2.70, ph$4.80 PB 149 226

Two new sensitive flux-gate magnetometers of the second harmonic type have been developed for use as H-measuring systems of a d-c single-strip permeameter. Both are employed with a simple bridge circuit which eliminates the necessity of complex filters and selective amplifiers and allows operation over a wide range of frequencies independent of source frequency stability. The first magnetometer is an open-magnetic-circuit type of two Supermalloy cores. The second magnetometer is a closed-magnetic-circuit type which does not influence the field being measured. The magnetometers were designed to measure fields from 1 milli-oersted to about 10 oersteds, although these are not physical limits of sensitivity. (Author)

Office of Technical Services, Dept. of Commerce, Washington, D. C.
MAGNETOSTRICTION. Aug 60, 6p. 59 refs. OTS Selective Bibliography SB-427.
Order from OTS $0.10 OTS SB-427

A bibliography of reports listed in the two OTS monthly abstract journals: U. S. Government Research Reports and Technical Translations. This bibliography covers reports added to the OTS collection during the period 1946 to September 1960.

Ohio State U. Research Foundation, Columbus.
THERMOMETERS FOR THE TEMPERATURE RANGE 0.1°K TO 20°K, by J. G. Daunt. Final rept. for 1 Sep 56-31 Aug 59 on Contract Nonr-495(13). 21 Oct 59, 16p. 22 refs. Rept. 712; AD-228 661.
Order from LC mi$2.40, ph$3.30 PB 149 504

An experimental investigation was made of the synthetic ruby as the working substance for a magnetic thermometer. An experimental study was conducted at low temperatures of some magnetic properties of a number of other gems and aluminas. The Cr ions in the synthetic ruby showed a paramagnetic behavior in the liquid He temperature region. The data obtained indicated the following advantages: (1) complete coverage of the entire range 0.1°K to 20°K, (2) extreme stability and reproducibility of the working thermometric substance, (3) ease of thermal contact with other materials, since ruby can be readily metallized, (4) good sensitivity, as ruby has a relatively high Curie constant, (5) high precision since the susceptibility can be accurately measured by ac bridges, (6) short time constant, since the material has a very small specific heat, (7) excellent temperature homogeneity throughout the thermometric specimen, and (8) cheapness and availability of the material.

Stanford Research Inst. [Menlo Park] Calif.
RADIO INTERFERENCE FROM CORONA DISCHARGES, by R. L. Tanner. Technical rept. no. 37 on Contract AF 19(604)266. Apr 53, 122p. 32 refs. SRI Proj. 591; AD-12 600.
Order from LC mi$6.30, ph$19.80 PB 149 057

Corona-discharge studies are described that were devoted specifically to the mechanisms by which electromagnetic disturbances are produced that cause interference with radio reception. The means by which these disturbances are coupled into a receiver are treated as well as the nature of the dependence of this coupling upon the geometrical configuration of the body on which the discharge occurs. A fundamental coupling theorem of considerable generality is developed which is based directly on Maxwell's field equations. The theorem can be applied in studying the noise signals coupled into the receiver from a discharge occurring at some remote corner of an aircraft; in addition, it is applicable to the converse situation: the dipole moment of the discharge can be inferred from the current pulse measured at the base of a discharge point and from certain supplemental electric-field investigations for the discharge electrode system.

Electronics

Air Force Cambridge Research Center, Bedford, Mass.
APPROXIMATE VALUES OF THE RADIATION HARMONICS FROM RELATIVISTIC CHARGES IN UNIFORM CIRCULAR MOTION, by E. A. Lewis. Jan 60, 51p. 9 refs. AFCRC-TR-60-113; AD-234 554.
Order from LC mi$3.60, ph$9.30 PB 148 248

Graphs and tables are given of approximate numerical values of the known expressions for the harmonic components in the radiation fields of a relativistic charge in uniform circular motion. These expressions contain Bessel functions of large order and large argument, evaluated by means of asymptotic and special interpolation formulas. (Author)

Air Force [Cambridge Research Center] Bedford, Mass.
ELECTRONIC MATERIAL SCIENCES LABORATORY. Semiannual status rept. no. 3, 1 June 60, 172p. 20 refs. AFCRC-TR-60-150.
Order from LC mi$8.10, ph$27.30 PB 150 162

This status report provides brief summaries of the Laboratory and Branch programs, research reports concerning work currently in progress, and summaries of contract activities. Details concerning missions to be performed, personnel assignments, publications, roster of contracts, and ARDC project structure are provided in appendices. (See also PB 146 349)

Antenna Lab., Ohio U. Research Foundation, Columbus.
THE BANDWIDTH OF LONG, UNIFORM ARRAYS OF PARASITIC DIPOLES, by Francesco Serracchioli. Rept. on Contract DA 36-039-sc-70174. 30 June 59, 38p. 8 refs. Rept. 662-33.
Order from LC mi$3.00, ph$6.30 PB 146 455

The introduction of surface waves in the study of end-fire arrays has led to the result that an infinity of array configurations, for a given over-all length, are equivalent with respect to far-field radiation at a given frequency. In this report a study is carried out on the behavior of end-fire arrays with respect to frequency variations about the design frequency. It is then shown that the aforementioned equivalence in general holds no longer if the frequency is varied about the design frequency. A definition of bandwidth is given for a uniform end-fire array, and accordingly a number of figures are calculated for different uniform dipole arrays. It is also shown that the condition of optimum directivity is a slowly varying function of the array length, so that is does not become a critical one to realize, even when the array is very long. (Author).

Armour Research Foundation, Chicago, Ill.
ELECTRON EMISSION PROCESSES BIBLIOGRAPHY, by Robert G. Pohl, and Martha Williams. Scientific rept. no. 1 on Super Power Cathode Study. Contract AF 30(602)2043. May 60, 341p. 3255 refs. ARF 1146-4; RADC TR-60-115; AD-238 963.
Order from LC mi$11.10, ph$53.10 PB 149 303

A comprehensive search of the literature relating to electron emission processes for the years 1947 to 1960 is contained in this report. Abstracts of the references are generally given, and complete cross-filing of a given reference into all pertinent subject categories has been maintained. The punched card coding system used in compiling the search is described. A convenient graph paper and an auxiliary scale for a slide rule, which are useful for determining effective work functions, are given and discussed in this report. (Author)

Armour Research Foundation, Chicago, Ill.
SUPER POWER CATHODE STUDY, by Robert G. Pohl. Final rept. no. 1, phase no. 1, for 1 June 59-30 June 60, on Contract AF 30(602)2043. 30 June 60, 71p. 45 refs. ARF-1146-5.
Order from LC mi$4.50, ph$12.30 PB 149 761

Barium nickelate, $BaNiO_2$, has been selected for study as a high power cathode material because of its low work function, 1.7 ev, and low evaporation rate. The effect of cathode processing changes on the thermionic emission, and on the surface and bulk crystal structure are reported herein. The available literature on nickelate cathodes is contained as reprints. (Author)

California U., Los Angeles.
EXTENSIONS IN SYNTHESIS TECHNIQUES FOR LINEAR SYSTEMS. PART I, by M. D. Schwartz and C. T. Leondes. Rept. on Contract AF 49(638)438. May 60, 60p. Dept. of Engineering rept. no. 60-38; AFOSR-TN-60-610.
Order from LC mi$3.60, ph$9.30 PB 150 253

Synthesis techniques for linear control systems with deterministic inputs have been based in main, thus far, on such highly idealized inputs as steps or ramps and such criteria as overshoot, rise time, and settling time. It would be desirable if analytical synthesis techniques were to be available for inputs which are arbitrary polynomial functions of time and for extended design criteria such as guarantying that the absolute value of system error is less than a specified required amount. This report presents such synthesis techniques, and in the process, establishes methods for guarantying that the minimum size power actuator is selected in the synthesis procedure. An additional consideration introduced in the synthesis techniques presented is the minimization of the complexity of the required compensation networks.

California U., Los Angeles.
EXTENSIONS IN SYNTHESIS TECHNIQUES FOR LINEAR SYSTEMS. PART II, by M. D. Schwartz. Rept. on Contract AF 49(638)438. May 60, 39p. 3 refs. Dept. of Engineering rept. no. 60-39; AFOSR-TN-60-609.
Order from LC mi$3.00, ph$6.30 PB 150 254

This report presents extensions in synthesis techniques for linear control systems for more general inputs and more general error criteria than were heretofore available in the control literature. (Author) (See also PB 150 253)

California U., Los Angeles.
ON THE SYNTHESIS OF OPTIMUM MULTIPOLE FILTERS, by Edwin B. Stear. Rept. on Contract AF 49(638)438. May 60, 10p. 7 refs. Dept. of Engineering rept. no. 60-27; AFOSR-TN-60-617.
Order from LC mi$1.80, ph$1.80 PB 150 250

Most of the developments in control systems theory in the past have been based on the one input-one output control system problem. However, in a great number of modern complex control system's problems, it is essential to approach the system design as a multipole or "n" input-"m" output design problem. For example, the optimal design of guidance and control systems for aerospace vehicles must be approached in this manner. Numerous results of basic importance to the design of such systems have been developed. This report presents some of the results obtained in the overall program.

California U., Los Angeles.
ON THE THEORY OF PROCESS ADAPTIVE CONTROL SYSTEMS, THE LEARNING MODEL APPROACH, by M. Margolis. Doctoral thesis. Rept. on Contract AF 49(638)438. May 60, 161p. 31 refs. Dept. of Engineering rept. no. 60-32; AFOSR-TN-60-618.
Order from LC mi$7.80, ph$25.80 PB 150 252

This dissertation attempts to extend the theory of feedback control to those systems that operate in a widely changing environment. The particular method devised for determining the dynamic characteristics of the process makes use of a model, referred to as the learning model, and a mechanism for adjusting the parameters of the learning model. The model is an analog of the process but with undetermined parameters. Both the model and the process are subjected to the same actuator signals. The response of the model is compared to the response of the process and the resulting error is used to activate the adjusting mechanism. It is the function of the adjusting mechanism to so set the parameters of the model that the model will behave as much like the process as possible. The particular method for adjusting the parameters of the learning model is based on an approximation to the method of steepest descent. The equations describing the operation of the adjusting mechanism are derived and result in a nonlinear nonautonomous system. The stability and dynamic response of the learning mechanism are examined by both analytic methods and computer experiments. The learning mechanism was found capable of tracking the parameters describing the process for a wide variety of actuating signals. (Author).

Electronics Research Lab., U. of California, Berkeley.
A STUDY OF THE HALL EFFECT IN GASEOUS CONDUCTORS, by B. N. Edwards. Scientific rept. no. 6 on Contract AF 19(604)2270. 30 Sep 59, 161p. 29 refs. Series no. 60; issue no. 253; AFCRC-TN-59-783.
Order from LC mi$7.80, ph$25.80 PB 149 559

An expression is derived for the dc Hall voltage across the positive column of a glow discharge tube. Experimental results are reported with a tube containing neon. Depending on the pressure and the current, these results show that the Hall voltage in different regions of the tube has opposite polarities; for example, the gaseous conductor may be p-type toward the cathode and n-type toward the anode. The use of the Hall effect in a gaseous conductor as a magnetometer is discussed. The conclusion is reached that such a device could have advantageous results in certain circumstances. The dc component of the Hall voltage at high frequency (without an external magnetic field) is derived by using both the radiation pressure concept and Lorentz's force equation, yielding identical results. Specific limitations on the applicability of the expression are deduced. The expression differs from that which appears in the literature. The result is interpreted to various situations of interest, viz., a plasma, a solid semiconductor, and a dielectric, for which numerical examples are given. The high-frequency conductivity of a gaseous conductor, including the effect of the high-frequency magnetic field, is calculated using Boltzmann's transport equation. Experimental attempts to measure the Hall voltage at high frequency in a plasma are described, and some experimental results are given. (Author)

General Electric Co., Schenectady, N. Y.
INVESTIGATION OF VARIOUS ACTIVATOR-REFRACTORY SUBSTRATE COMBINATIONS, by J. H. Affleck. Scientific rept. no. 8 on Contract AF 19(604)4093. 6 June 60, 20p. 9 refs. AFCRC-TN-60-576; AD-239 219.
Order from LC mi$2.40, ph$3.30 PB 148 926

(See also PB 145 364)

Institute of Mathematical Sciences, New York U., N. Y.
A NOTE ON THE LOCAL STRUCTURE OF SHOT NOISE, by R. A. Silverman. Rept. on Contract AF 19(604)5238. May 60, 11p. 4 refs. Research rept. no. EM-160; AFCRC-TN-60-396.
Order from LC mi$2.30, ph$3.30 PB 150 056

By appropriately choosing the pulse shape and the shot density, shot noise is constructed which, like the turbulent velocity field, is accurately univariate normal, but has a markedly non-normal bivariate distribution at close ranges. Both the one-dimensional and three-dimensional cases are discussed. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
SURFACE WAVES ON A REACTIVE HALF PLANE, by Julius Kane. Rept. on Contract AF 19(604)5238. May 60, 31p. 4 refs. Research rept. no. EM-159; AFCRC-TN-60-554.
Order from LC mi$3.00, ph$6.30 PB 150 057

The following two-dimensional problem is considered: An arbitrary antenna is located at the origin which launches surface waves on a reactive half-plane $y = 0$, $x < 0$. It is assumed that the other half-plane, $y = 0$, $x > 0$ is occupied by a perfect conductor. The antenna is approximated by a distribution of multipoles easily found from the antenna's radiation pattern. With this approximation, simple algebraic expressions are obtained for the ratio of the power delivered to the surface waves as compared to the power in the radiated cylindrical field. (Author)

Stanford Electronics Labs., Stanford U., Calif.
THE D-C PUMPED QUADRUPOLE AMPLIFIER: A WAVE ANALYSIS, by A. E. Siegman. Rept. on Contract DA 36-039-sc-73178. 2 Mar 60, 13p. 5 refs. Technical rept. no. 159-1; AD-237 238.
Order from LC mi$2.40, ph$3.30 PB 147 751

The 'Larmatron' is a quasi-parametric electron-beam amplifier recently announced by Gordon and others. It uses the same transverse beam waves as the Adler-Wade quadrupole amplifier, but the pumping is done by d-c voltages applied via a twisted quadrupole structure. This paper analyzes the d-c pumped case in terms of the four transverse beam waves and their coupling. Amplification is found to be the result of coupling between the fast and slow cyclotron waves. The pump voltage does not really pump, i.e., it does not supply any energy. Another d-c pumping scheme is also examined and found not to give amplification. (Author)

Tufts U., Medford, Mass.
ON SOLUTIONS OF THE HEAT EQUATION, James A. Clarkson and Dawson G. Fulton. Scientific rept. no. 2 on Contract AF 19(604)1578. 21 July 59, 29p. AFCRC-TN-59-449; AD-235 068
Order from LC mi$2.70, ph$4.80 PB 147 877

Let $H(f;x,t)$ be the temperature, at point x and time t, in a semi-infinite rod, initially at temperature zero, whose free end is maintained at temperature given by the function $f(t)$. The solution given by $H(f;x,t) = \frac{x}{2\sqrt{\pi}} \int_0^t s^{-3/2} e^{-x^2/4s} f(t-s)ds$ is considered. For many simple functions $f(t)$ it is true that $I(f;x,T) = \int_0^T (H_x^2 - HH_{xx})dt \geq 0$ for all x, $T > 0$. It is shown that $I(f;x,T)$ can be negative for certain values of x and T, even for comparatively uncomplicated drive functions $f(t)$.

Molecular Physics and Spectroscopy

Aerojet-General Corp., Azusa, Calif.
THE DEVELOPMENT OF A MASS SPECTROMETER FOR ION STUDIES, by R. J. Sunderland and J. R. Radbill. Rept. on Contract AF 49(638)214. June 60, 24p. 2 refs. Aerojet rept. TN-35; AFOSR-TN-60-702; AD-240 229.
Order from LC mi$2.70, ph$4.80 PB 149 561

Mechanisms for the production of positive ions on metallic and nonmetallic surfaces are being investigated. In order to determine the mass spectrum of the emission from a particular source, a magnetic-sector-field mass spectrometer has been constructed. This instrument is a first-order-focusing type, having a 60°-sector magnetic field in which the ion trajectories have a 5-in. radius of curvature. The spectrometer is constructed entirely of metal, with the central portion of the tube forming the pole faces of the magnet, which has high-impedance windings. The magnet-current power supply, regulated to 1 part in 10^4, is capable of generating fields greater than 16,000 gauss in the focusing region. The precision accelerating voltage is also regulated to 1 part in 10^4 up to 15 kv at 10 ma. The system is evacuated by a 6-in. oil-diffusion pump which is well trapped with liquid nitrogen; pressures throughout the system are of the order of 10^{-6} mm Hg.

Battelle-Institut E. V., Frankfurt-am-Main (West Germany).
DEVELOPMENT OF AN ANALYTICAL METHOD FOR EMISSION-SPECTROGRAPHIC DETERMINATION OF ALKALI WITHOUT CLASSICAL CHEMICAL METHODS OF PREVIOUS FUSION OR DISSOLVING. Final rept. for 1 Dec 59-15 May 60 on Contract DA 91-591-EUC-1346. [1960] 23p.
Order from LC mi$2.70, ph$4.80 PB 149 430

Two methods are described for the rapid spectrographic analysis of alkali in a variety of test materials. If the Na 3302 and K 4044 spectral lines are used for analysis, standard spectrographic equipment with ultra-violet sensitive film can be used. The precision of this method permits quantitative analyses to as low as 0.1 per cent Na_2O. If the Na 5890 and K 7655 lines are used, even smaller alkali concentrations can be determined and the preparation of the samples is easier because the analytical sample is merely diluted with graphite powder. As it is often difficult to procure special films sensitive to infrared light, this method is only recommended for routine work. With slight variations, the second method can also be used for determinations of very small alkali concentrations in organic substances.

Clarendon Lab., U. of Oxford (Gt. Brit.)
ELECTRON SPIN RESONANCE OF Gd^{+++} IN LANTHANUM FLUORIDE, by D. A. Jones, J. M. Baker, and D. F. D. Pope. Technical (Scientific) note no. 1 on Contract AF 61(052)92. Mar 59, 18p. 9 refs. AFCRC-TN-59-580; AD-234 549.
Order from LC mi$2.40, ph$3.30 PB 147 876

Electron spin resonance in a single crystal of LaF_3 containing 0.01% Gd^{+++} shows 3 magnetically distinguishable ions per unit cell in a rhombic crystalline electric field which is consistent with a hexamolecular unit cell of symmetry 06/mcm. This is in disagreement with recent crystallographic measurements, but in agreement with the interpretation of the Faraday rotation given by Van Vleck and Hebb (Phys. Rev. 46.17, 1934). The parameters of the spin Hamiltonian are given. The crystal field splitting in zero magnetic field is $\sim 0.3\ cm^{-1}$ which makes this a possible salt for maser operation in low magnetic field. (Author)

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE AND OPTICAL SPECTRUM OF IRON IN BERYL, by M. Dvir and W. Low. Technical note no. 13 on Contract AF 61(052)59. May 60, 21p. 9 refs. AFOSR-TN-60-994.
Order from LC mi$2.70, ph$4.80 PB 150 355

The paramagnetic resonance spectrum of Fe^{3+} in beryl was measured at 20° and 290°K. In addition to this spectrum many weak lines were observed and possible explanations of these lines are discussed. The optical spectrum shows a spectrum characteristic of trivalent iron. In the infrared region there are several groups of sharp lines whose origin is not yet known. (Author)

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE AND OPTICAL SPECTRA OF DIVALENT IRON IN CUBIC FIELDS. I. THEORY. II. EXPERIMENTAL RESULTS, by W. Low and M. Weger. Technical note no. 14 on Contract AF 61(052)59. May 60, 99p. 23 refs. AFOSR-TN-60-801.
Order from LC mi$5.40, ph$15.30 PB 150 344

The energy level splittings of the ground state of the d^6 configuration in cubic and axial fields are given. The Zeeman splittings of the various levels are calculated for weak and strong magnetic fields. In the case of tetrahedral symmetry the effect of the perturbation of the odd parity configurations d^5p and d^5f on the ground state is estimated. The paramagnetic resonance absorption of Fe^{2+} in MgO is observed at $g = 3.428$ and 6.86. The optical absorption line is found at 10,000 cm. The paramagnetic resonance spectrum indicates considerable covalent bonding. The origin of the line at 6.86 is discussed. In tetrahedral ZnS a paramagnetic line is found at $g = 2.25$ and optical absorption at 3μ and 0.7μ. Possible explanations of this spectrum are discussed. A short discussion of the optical absorption spectra of trivalent iron in MgO is presented. (Author)

Hebrew U. (Israel).
PARAMAGNETIC RESONANCE SPECTRUM OF Mn^{2+} IN $ZnSiF_6{:}6H_2O$, $\Delta m = \pm 1$ TRANSITION, by E. Friedman and W. Low. Technical note no. 15 on Contract AF 61(052)59. June 60, 12p. 3 refs. AFOSR-TN-60-995.
Order from LC mi$2.40, ph$3.30 PB 150 356

In the spectrum of Mn^{2+} in $ZnSiF_6{:}6H_2O$ a number of weaker lines are observed at intermediate angles of the magnetic field H with respect to the crystal axis, in addition to the 30 allowed transitions $\Delta M = \pm 1$, $\Delta m = 0$. These lines have been measured and assigned

to $\Delta M = \pm 1$, $\Delta m = \pm 1$ transitions. The relatively strong intensity is explained and the intensity of the lines is shown to be proportional to $(D/A)^2 \cos^2\theta \sin^2\theta$. These forbidden transitions can be utilized for dynamic polarization of manganese nuclei. (Author)

Heidelberg U. (West Germany).
PROGRAM: "BROOKHAVEN" CONFERENCE [NO. 4] ON NUCLEAR BEAMS JUNE 9-11, 1959, UNIVERSITY OF HEIDELBERG, HEIDELBERG, GERMANY. [1959] 54p. 17 refs. AFOSR-TR-59-152; AD-228 005.
Order from LC mi$3.60, ph$9.30 PB 150 152

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
APPLICATION OF SUMMABILITY METHODS TO SPECIFIC HEAT CALCULATIONS, by A. A. Maradudin, G. H. Weiss, and R. A. Sack. (Laboratory for Molecular Studies). Rept. on Contract AF AF 18(600)1315. Mar 60, 16p. 5 refs. Technical note BN-201; AFOSR-TN-60-345; AD-235 771.
Order from LC mi$2.40, ph$3.30 PB 148 996

Thirring obtained an expansion for the vibrational contribution to the specific heat of a crystalline solid in powers of 1/T. The coefficients of this Taylor series are proportional to successive moments of the frequency spectrum. Thirring's expansion converges only for $T > \Theta/2\pi$, where $\Theta = h\omega_L/k$ and ω_L is the maximum normal mode frequency. The series converges very poorly near the radius of convergence and is completely useless there. The series can be analytically continued beyond its radius of convergence by means of the Euler transformation, which, greatly increases the rate of convergence of the series near the radius, so that only about 7 moments are required for better than 3 figure accuracy for the specific heat of a body-centered cubic lattice at this point. Other methods for summing divergent series can also be used effectively. Some examples of the use of these methods are presented. (Author)

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
SATURATION OF THE MAGNETIC RESONANCE ABSORPTION IN DILUTE INHOMOGENEOUSLY BROADENED SYSTEMS [AND] MAGNETIC RESONANCE AND RAPID PASSAGE IN IRRADIATED LiF, by James S. Hyde. Rept. on Contract Nonr-1841(10). Oct 59, 49p. 29 refs. Technical rept. nos. 141, 142; AD-228 364.
Order from LC mi$3.30, ph$7.80 PB 149 938

Portis proposed a theory of inhomogeneous saturation in which an integration is carried out of the contributions to the magnetic loss by spin packets precessing at a distribution of Larmor frequencies. The shape of the spin packets critically determines the saturation behavior. In this paper the theory of Portis is reviewed and a number of criticisms and modifications of the theory are presented. The experimental result of Portis that at room temperature the paramagnetic dispersion signal ($d\chi'_m/dH$) of radiation-induced paramagnetic centers in LiF has the shape of an undifferentiated Gaussian curve and lags the modulation field by 90 degrees has been confirmed.

Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.
DIRECT DETERMINATION OF LINE SHAPES OF ROTATIONAL SPECTRA FROM INTERFEROMETRIC MEASUREMENTS, by Trevor Williams. Technical rept. on Contract AF 18(600)1307. 30 Sep 59, 22p. 2 refs. AFOSR-TN-60-349; AD-239 732.
Order from LC mi$2.70, ph$4.80 PB 149 161

Much idealized, the rotational spectrum of a linear molecule may be considered to consist of a number of equally-spaced lines of identical shapes and intensities. We have been scanning such spectra with an interferometer rather than a conventional grating spectrometer. It is consequently of interest to know what kind of interferogram may be expected to arise from a periodic spectrum. It is shown that all the structure in the interferogram is contained in a sequency of "signatures" at path differences of $0, 1/2B, 2/2B, \cdots$ For a symmetric line shape the signatures are all symmetric and homologous, but asymmetry in the line shape introduces increasing asymmetry in the successive signatures. These predictions are in agreement with experience. By measuring two vertical distances on each signature it is possible to determine as many harmonics in the Fourier expansion of the line shape as there are signatures. Comparison with experimental results from the large interferometric modulator at The Johns Hopkins University will be given. (Author)

Maryland U., College Park.,
DELTA FUNCTION MODEL OF CHEMICAL BINDING, by Ellis R. Lippincott and Margaret Oakley Dayhoff. Rept. on Contract DA 36-034-ORD-2175. Mar 59, 56p. 16 refs. OOR rept. 1607.6C; AD-214 751.
Order from LC mi$3.60, ph$9.30 PB 149 653

A semi-empirical delta function model of chemical binding is presented from which a large number of bond properties may be calculated for diatomic molecules and the bonds of polyatomic molecules. The predicted properties are dissociation energy, bond length, vibrational frequency and anharmonicity.

Minnesota U. School of Chemistry, Minneapolis.
CARBON-13 HYPERFINE SPLITTING IN SEMIQUINONES, by D. C. Reitz, F. Dravnieks, and J. E. Wertz. Rept. on Contract AF 18(603)17. 31 Aug 60, 7p. 5 refs. AFOSR-TN-60-929.
Order from LC mi$1.80, ph$1.80 PB 150 238

The electron spin resonance spectra of 2,5-dihydroxysemiquinone and semiquinone exhibit hyperfine splittings consistent with the number of ring protons on each molecule. In addition, there are lines of weak intensity in both spectra which may be attributed to the natural abundance of C^{13} in ring carbon atoms.

Oregon U., Eugene.
THE POSITION DEPENDENCE OF COLLISION INDUCED SATELLITES OF ALKALI LINES ON THE NATURE OF THE ALKALI, by Shang-Yi Ch'en and Ralph A. Wilson, Jr. Interim technical rept. no. 4 on Contract DA 04-200-ORD-713. June 60, 28p. 3 refs. OOR rept. no. 1981.5-P.
Order from LC mi$2.70, ph$4.80 PB 150 394

The dependence of the positions of both the red and the violet satellite bands of alkali lines in absorption, resulted from collisions between the alkali atoms and various foreign gases, on the nature of alkalis was investigated from the microphotometer traces of over 100 satellites of the absorption lines of Li, Na, K, Rb and Cs in the presence of He, Ne, Ar, Kr, and Xe. For a given foreign gas, the absolute magnitudes of satellite-line separation, $|\Delta\nu|$ in cm^{-1} for both red and violet satellites decreased with increasing atomic weight of the alkalis; while for a given alkali, the $|\Delta\nu|$ increased for red satellites but decreased for violet satellites with the atomic weights of the foreign (perturbing) gas. Red satellites were observable only for heavy gases (Kr and Xe).

Rochester U., N. Y.
IMPURITY STATES IN SOLID NEON, by Albert Gold. Rept. no. 6 on Contract AF 49(638)432. June 60, 68p. 45 refs. AFOSR-TN-60-705.
Order from LC mi$3.90, ph$10.80 PB 150 201

A formalism for the treatment of optical absorption by an isolated substitutional impurity center is given. The tight-binding approximation is used and the method of constructing one-electron trial functions for the system is outlined. The first-order absorption energies, oscillator strengths, and integrated absorption coefficients are computed in an approximation which includes spin-orbit interaction and the overlapping of heterocentric atomic wave functions through terms of order S^2. The first-order energies are corrected for van der Waals interactions using a variational formalism. A phenomenological method for computing the emission energies of the system is given. The specific example of an argon impurity atom in solid neon is treated numerically. The computation predicts absorption lines at 11.7 and 11.6 eV due, respectively to the $^1P_1$ and $^3P_1$ states of the argon impurity, with an uncertainty of 1.3 eV. The oscillator strengths for these transitions are calculated to be 0.164 and 0.017 respectively, giving rise to integrated absorption coefficients of 0.84×10^6 N_o and 0.09×10^6 N_o eV cm^{-1} for the two states, where N_o is the (small) fractional concentration of impurities in the host lattice. (Author)

Optics

Army Chemical Warfare Labs., Army Chemical Center, Md.
INFRARED FILTER MATERIALS FOR APPLICATION TO LOPAIR (LONG-PATH INFRARED) SYSTEMS, by Hugh R. Carlon. 1 June 59, 20p. 4 refs. CWL Technical memo. no. 32-42; AD-217 807.
Order from LC mi$2.40, ph$3.30 PB 150 103

The physical, optical and spectral characteristics of various filter materials for use in the construction of infrared detector filter wheels (fluorothene, talc, Teflon, polyethylene, indium antimonide, calcium fluoride, and barium fluoride) were discussed. The types discussed were plastic films, fused salts, minerals, and special alloys. Wherever possible, spectral characteristics were shown for various thicknesses of the materials. Teflon, polyethylene, indium antimonide, and calcium fluoride were in the infrared beam. No attempt was made to correct the curves to represent the actual radiation seen by the detector as a result of radiation characteristics of the infrared source. If such a correction were made, the area under both curves would be equal, and the condition of optical balance would be verified mathematically. Peak efficiency for the system discussed was 35%, but it is possible to select materials resulting in 50% efficiency.

Columbia U., New York
POINTS OF MULTIPLICITY OF PLANE BROWNIAN PATHS, by A. Dvoretzky, P. Erdös, and S. Kakutani. Rept. on Contract Nonr-266(59). June 59, 9p. 4 refs. CU-5-59-Nonr-266(59)MS.
Order from LC mi$1.80, ph$1.80 PB 147 893

Hughes Research Labs., Malibu, Calif.
FUNDAMENTAL LIMITATION IN THE POINTING ACCURACY OF A RADIO TELESCOPE, by Nicholas George. Scientific rept. no. 2 on Contract AF 19(604)5725. 1 Apr 60, 22p. 7 refs. AFCRC-TN-60-585.
Order from LC mi$2.70, ph$4.80 PB 149 912

The angular pointing accuracy of a radio telescope is limited by the finite angular width of the diffraction pattern of the receiving aperture and by the presence of noise in the receiver. A formula is derived which expresses the angular uncertainty inherent in training a radio telescope toward a point source as a function of the flux level of the source, the bandwidth and the sensitivity of the receiver, the observation time, and the angular rate of change of the diffraction pattern. This formula is applied to the case of a weak source of cosmic radio waves, and it is found that if the source spectral intensity varies as $1/f^{\mu}$, then the angular pointing accuracy varies with frequency as $1/f^{1-\mu}$. For non-thermal sources, an average value of $\mu = 0.8$ is reported in the literature, and thus one finds only a slight frequency dependence of the angular pointing accuracy, i.e., as $1/f^{0.2}$. This result is valid for any aperture shape, and in this paper appropriate formulas are given for the linear, rectangular, and circular apertures. Finally, a sample computation indicates that an angular pointing accuracy of 30 seconds of arc is possible using present-day receiver components and an aperture size of 3.4 meters (approximately). The effects of atmospheric turbulence, dimensional tolerance, and mechanical stability are not considered. (Author)

Itek Corp., Waltham, Mass.
COMMUNICATION THEORY AND SCALAR DIFFRACTION THEORY, by Edward L. O'Neill, Richard Barakat, and David E. Lev. Final rept. on Contract AF 19(604)5544. Apr 60, 121p. 51 refs. Itek P-168; AFCRC-TR-60-142.
Order from LC mi$6.30, ph$19.80 PB 149 435

This report attempts to present solutions to certain problems in visible optics which in the course of events should prove to be of considerable interest to those in the microwave field. Chapter I is concerned

with an extension of the Maréchal scheme for phase error balancing to fifth order terms. In Chapter II, the transfer functions for representative high numerical aperture systems are calculated and plotted. Chapters III and IV are concerned with the numerical evaluation of the axial energy distribution and the contours of constant encircled energy for various amounts of spherical aberration at several focal positions. Chapter V deals with the solution of three problems of scalar diffraction theory posed by Luneberg but not completed.

Lincoln Lab., Mass. Inst. of Tech., Lexington.
PREPARATION AND PERFORMANCE OF SINTERED CdS PHOTOCONDUCTORS, by R. R. Billups, W. L. Gardner, and M. D. Zimmerman. Rept. on Contract AF 19(604)5200. 12 Mar 59, 15p. 10 refs. Technical rept. no. 200; AD-212 580.
Order from LC mi$2.40, ph$3.30 PB 147 010

This report released for sale to the public 13 Oct 60.

The performance of sintered CdS layers is dependent upon their activation and the parameters of the sintering process. A procedure of activation of Cds powders is given with an accompanying discussion of techniques used in the production of sintered layers. Data are presented relating the dependency of the electrical and optical characteristics of the sintered layer with variations in activation and in the sintering parameters, such as atmosphere, temperature and time of bake, and method of cooling. Sintered layers of desired characteristics can be produced and data from such layers are discussed. Examples are given as to how these layers are utilized in device applications. (Author)

Naval Ordnance Lab., Corona, Calif.
INTERFEROMETRIC MEASUREMENT OF WAVELENGTHS OF INFRARED EMISSION LINES IN THE 1- TO 2- MICRON REGION, by Curtis J. Humphreys and Edward Paul, Jr. 19 Feb 58, 31p. 15 refs. NAVORD rept. 4636; NOLC rept. 390; AD-162 994.
Order from LC mi$3.00, ph$6.30 PB 149 771

A method was developed for the precise evaluation of spectral emission lines in the 1- to 2-μ region by interferometric intercomparison with selected internationally adopted wavelength standards. The essential feature of the method is the provision for scanning the interference pattern by uniform rotation of a Fabry-Perot interferometer so that a diametral section of the system of circular fringes moves across the slit of a high-resolution infrared spectrometer. Data are obtained in the form of chart records of the fringe positions. NOLC digital computer facilities are utilized for reduction. Aluminum coatings proved satisfactory. Interferometer separations up to 30 mm were used in reported work. Wavelengths are reported as follows: argon, 19 lines; krypton, 15 lines; natural mercury, 10 lines, mercury 198, 8 lines; cadmium, 4 lines; helium, 1 line, namely, λ 20581A. The absolute accuracy now being achieved is 1 part in 10^7 in favorable cases. (Author)

Washington Square Coll., New York U., N. Y.
A STUDY OF THE FAR INFRARED PROPERTIES OF CRYSTALS, by J. H. Rohrbaugh. Scientific rept. no. 9, 1 Sep-31 Nov 59, on Millimeter Wave Project, Contract AF 19(604)2673. [1959] 25p. 7 refs. AFCRC-TN-60-157; AD-234 816.
Order from LC mi$2.70, ph$4.80 PB 147 880

The optical behavior of the NaCl crystal in the infrared is investigated at various temperatures. Neuberger's [J. Neuberger, Absorption of NaCl in the Infrared, Thesis, New York Univ., 1957] derivation is used near room temperature. Neuberger applies the Blackman anharmonic theory to the Kellerman model of the NaCl crystal for his derivation of the optical constants. At low temperatures, his damping factor had to be modified by including the zero point energy. This was obtained by the use of the previously derived 2°K frequency spectrum of the normal modes of vibration. It is seen that the change of the optical constants is already experimentally detectable with the experimental accuracy currently achievable for a difference of 20°K near room temperature. (Author)

Solid State Physics

Armour Research Foundation, Chicago, Ill.
MECHANISM OF WEAR OF NONMETALLIC MATERIALS, by C. H. Riesz. Rept. for May 59-Jan 60 on Research on Interface Phenomena, Contract AF 33(616)5962. May 60, 25p. 14 refs. WADC Technical rept. 59-316, Part II.
Order from OTS $0.75 PB 161 955

A fundamental study was made of the wear mechanism of nonmetallic materials at high temperatures. Single-crystal sapphire was examined in a friction apparatus made for studies up to 2200°C. A sapphire ball loaded at 22, 50, and 127 g was passed over a sapphire plate at .0053 cm/sec at 29-921°C. Both slider and plate were oriented such that the C_O-axis was normal to the direction of traverse. With cleaned, as-received materials coefficient of friction values were scattered. Prior heat treatment at 900-925°C reduced scatter and gave peak values of .25-.30 near 600°C. The results suggest that the surfaces of the sapphire were imperfect. Observations by other investigators on variation of modulus of rupture appear to have a common basis. Wear areas on ball and plate were 6μ wide; subsurface changes extended to 30μ. Electron microscopy inspection suggests high surface temperatures occurred coincidently with the friction process, but direct evidence of an adhesion mechanism is inconclusive. (Author)

Battelle Memorial Inst., Columbus, Ohio.
EFFECT OF HIGH PRESSURE ON ELECTRICAL PROPERTIES OF NiO, CoO AND Cu_2O, by A. P. Young, W. B. Wilson, and C. M. Schwartz. Technical note no. 1 on Contract AF 49(638)441. 1 Sep 60, 27p. 20 refs. Technical Document AFOSR-TN-60-629.
Order from LC mi$2.70, ph$4.80 PB 150 266

The effect of pressure on electrical resistance and Seebeck coefficient at or near room temperature in NiO, CoO, CuO, and Cu_2O has been determined. Equations relating the Seebeck coefficient to hole concentration have been used to calculate the effect of pressure on hole mobility. In all materials examined, hole mobility was decreased by pressures to 60 000 atm. It has been proposed that NiO charge transport occurs by the motion of holes trapped at local sites by polarization of the surrounding lattice. The effect of pressure on the diffusion of self-trapped holes has been considered. Motion of self-trapped holes in an ionic crystal and of vacancies in a metal may be similar to the extent that the motion of either probably involves cooperative movements of surrounding ions or atoms. Some inward relaxation probably occurs around either a hole trapped at a local site in an ionic crystal or around a vacancy in a metal. In either case pressure would be expected to decrease the jump frequency for motion of the defect. It is proposed that in NiO, CoO, and CuO, the decreased hole mobility with pressure was due to a decrease in diffusion rate of self-trapped holes. The explanation for pressure effects in Cu_2O may be more complicated since Cu_2O is generally regarded as a wide band semiconductor. (Author).

Brown U., Providence, R. I.
INVESTIGATIONS OF SURFACE PROPERTIES OF SILICON AND OTHER SEMICONDUCTORS, PHASE I AND II, by H. E. Farnsworth, D. Haneman and others. Scientific rept. no. 3, 30 Apr-30 June 60, on Contract AF 19(604)5986. July 60, 19p. 12 refs. ERD TN-60-775.
Order from LC mi$2.40, ph$3.30 PB 150 208

Measurements on a $(11\bar{1})$ GaSb face have been extended to include secondary emission observed as a function of oxygen and carbon dioxide adsorption. Diffraction and adsorption measurements have also been made on a (111) GaSb face. The adsorption rates of oxygen and carbon dioxide were greater by about a factor of 10 for the $(11\bar{1})$ face than for the (111) face. A germanium crystal was subjected to wet and dry cycles of nitrogen and oxygen. The effects of these ambients on the surface recombination states was determined by combined measurements of surface recombination velocity and surface conductivity. Studies of the formation of p-type films on vacuum-heated silicon have continued. The original baking temperature of the vacuum system has been varied over the range from 300°C to 450°C without influencing the number of diffused acceptors. Results have been obtained for a (110) silicon crystal which are in conformity with those previously obtained for the (100) and (111) crystal faces. (See also PB 147 758)

Brown U. Div. of Applied Mathematics, Providence, R. I.
DIMENSIONAL CHANGES IN CRYSTALS DUE TO DISLOCATIONS, by R. A. Toupin and R. S. Rivlin. Technical rept. no. 51 on Contract Nonr-562(10). Oct 59, 28p. 4 refs. C11-51; AD-228 130.
Order from LC mi$2.70, ph$4.80 PB 149 945

The second-order elasticity theory is used to show how changes in the average dimensions of elastic bodies, either isotropic or anisotropic, due to the introduction of dislocations, can be calculated when the displacement gradients produced by the dislocations are sufficiently small. It is shown that the average value of each of the stress components, in a rectangular Cartesian coordinate system, is zero. This result is then used, within the framework of the second-order theory, to obtain an expression for the average value of each of the infinitesimal strain components as the average value of an expression of second degree in the displacement gradients which are associated with the dislocations in the body according to the classical theory. (Author)

Brown U. Div. of Applied Mathematics, Providence, R. I.
STRESS ANALYSIS IN THE PLASTIC RANGE, by William Prager. Technical rept. no. [52] on Contract Nonr-562(10). Oct 59, 24p. 28refs. C11-52; AD-228 129.
Order from LC mi$2.70, ph$4.80 PB 149 946

Problems of plastic stress analysis are illustrated by using a truss as an example. The state of stress can be specified by the values of a finite number of parameters. For this discrete model, linear programming, quadratic programming, and differential quadratic programming are shown to be important tools of plastic stress analysis. In discs, plates, and shells, and in the 3-dimensional continuum, the state of stress is specified by functions of position. While extreme characterizations of the state of stress were given and individual problems were solved for these continuous models, efficient methods of plastic stress analysis have yet to be developed. In view of the complexity of the problem, there is no doubt that these methods will have to be numerical rather than analytical. (Author)

Colorado U., Boulder.
NUCLEAR RESONANCE OF Al IN SYNTHETIC RUBY. Technical note on Contract AF 49(638)611. June 60, 8p. 6 refs. AFOSR-TN-60-724.
Order from LC mi$1.80, ph$1.80 PB 149 837

The quadrupole coupling constant $\Delta\nu$ and the line widths of Al were investigated at 300°K, 77°K, and 4.2°K and Cr^{3+} impurity concentrations of 0.1%, 1.5%, and 4%. The results indicated that the most significant contribution to the line width was the nuclear dipole-dipole interaction except for the 4% crystal at 4.2°K where the paramagnetic dipole-nuclear dipole interaction became important.

Compagnie Générale de T[élégraphie] S[ans] F[il] (France).
PREPARATION OF II-IV SEMI-CONDUCTOR COMPOUND MIXTURES AND MEASUREMENT OF THEIR ELECTRICAL AND THERMAL PROPERTIES. Quarterly status technical rept. no. 4, 1 Jan-30 Mar 60, on Contract AF 61(052)243. [1960] 24p. AD-237 885.
Order from LC mi$2.70, ph$4.80 PB 148 213

Single crystals of Mg_2Sn about 8 cm long were obtained regularly by using a heating element whose interior tube was of alumina and in which the interval between tubes was filled with powdered alumina. The

first crystals obtained were n type with the number of carriers of the order of 10^{18}/cc. Spectrographic analysis revealed traces of Cu and Ca and extremely faint traces of Si, Fe, and Ni. After fusion with the same heating element, n or p type crystals with the number of carriers of the order of 10^{17}/cc were obtained. The type is apparently imposed by stoichiometric departure so that if the speed of cooling is controlled, crystals of Mg_2Sn which are very close to the theoretical composition may be obtained. Measurements of resistivity and Hall coefficient were made on 2 single crystals, one each of the n and p types. The samples, A_1 and A_2, were taken from the head and tail of the same ingot. At liquid air temperature, the number of A_1 carriers was one-tenth that of the A_2. Phase studies indicated Pb and Sn are unequally distributed along the length of a crystal if the ingot is slowly recrystallized, starting at one end. A method for measuring semiconductor thermal diffusivity is appended; one end of a cylindrical bar is maintained at constant temperature and the other receives a periodic thermal flux of energy. The solution is derived by superposing the nonperiodic and periodic states, given the characteristic linear heat equation and boundary conditions. (See also AD-236 763)

Conservatoire des Arts et Métiers, Paris (France).
X-RAY DIFFRACTION IMAGES OF A CRYSTALLINE SURFACE, by M. Cagnon and A. Guinier. Technical note no. 2 on Contract AF 61(052)51. Jan 60, 27p. 7 refs. AFOSR-TN-60-681.
Order from LC mi$2.70, ph$4.80 PB 149 588

The influence on the X-ray image of defects such as superficial scratches, subboundaries, slip planes has been studied in detail with a lithium flouride crystal. The first part of the work has been the construction of a convenient camera and the study of the conditions necessary to obtain a satisfactory geometrical resolving power.

Detroit U. [Mich.]
DEVELOPMENT OF A MATHEMATICAL THEORY OF PLASTICITY BASED ON THE CONCEPT OF SLIP III, by H. Payne, S. J. Czyzak and others. Rept. on Contract AF 19(600)1466. 1 Sep 60, 58p. 24 refs. AFOSR-TR-60-107.
Order from LC mi$3.60, ph$9.30 PB 150 242

The Taylor model can be considered as the more realistic one of the several which have been proposed and the modifications of this model by Lin, Bishop and Hill, and Payne have made it possible to solve the stress-strain relation for certain problems. The fact that good agreement between theory and experiment has been obtained for these problems justifies acceptance of the model as one which describes the behavior of material under stress. The Taylor model has been investigated quantitatively for face centered cubic crystals only. (See also PB 144 773)

Electronic Systems Lab., Mass. Inst. of Tech., Cambridge.
AN INVESTIGATION INTO THE THERMAL AND ELECTRICAL PROPERTIES OF THE MERCURY-TELLURIDE CADMIUM-TELLURIDE SEMI-CONDUCTOR SOLID SOLUTION SYSTEM, by John Blair. Scientific rept. no. 2 on Contract AF 19(604)4153. 15 June 60, 99p. 66 refs. AFCRC-TN-60-753; DSR-7994.
Order from LC mi$5.40, ph$15.30 PB 150 051

This report deals with three separate but essentially interrelated subjects. The thermal and electrical properties of dilute solid solutions of cadmium telluride in mercury telluride are investigated, and techniques are developed for the preparation and evaluation of single crystals in this material system. The common focal point in this investigation was provided by thermoelectric energy conversion.

General Electric Research Lab., Schenectady, N.Y.
DIFFUSION OF Li IN Si AT HIGH T AND THE ISOTOPE EFFECT, by E. M. Pell. Scientific rept. no. 2 on Contract AF 19(604)5551. 25 Feb 60, 31p. 25 refs. AFCRC-TN-60-182; AD-234 621.
Order from LC mi$3.00, ph$6.30 PB 148 247

The diffusion rate of Li in Si at high temperatures has been re-investigated using an outdiffusion technique. The resulting D for Li-7 is $(2.21 \pm 0.07) \times 10^{-6}$ cm^2/sec at $(800 \pm 5)^oC$ and 2.4×10^{-5} cm^2/sec at $(1350 \pm 5)^oC$. At 800°C, the value for D_{Li-6}/D_{Li-7} is $1.075 \pm .02$, in accordance with the expected inverse dependence on the square root of the mass. The ionic charge of the Li and the atomic mechamism for Li diffusion is discussed in the light of these and other results.

General Telephone and Electronics Labs., Inc., Bayside, N. Y.
INFRARED SCATTERING STUDY, by G. H. Schwuttke. Final rept. on Contract AF 19(604)3482. 30 Apr 60, 72p. 30 refs. TR 60-300.7; AFCRC-TR-60-157.
Order from LC mi$4.50, ph$12.30 PB 150 094

Imperfections in silicon single crystals have been studied by means of infrared light scattering, copper decoration, and X-ray extinction microscopy. Scope and limitations of these three methods have been explored and compared with etching techniques. Measurements have been conducted to check the reliability of etching and decoration techniques in crystals of low and high oxygen concentration, using X-ray extinction photomicrographs as standards. (Author) (See also PB 142 964)

Georgia Inst. of Tech. Engineering Experiment Station, Atlanta.
X-RAY DIFFRACTION STUDIES OF THERMAL MOTIONS IN CRYSTALS, by R. A. Young. Annual rept. no. 1, 1 June 58-31 May 59, on Contracts Nonr-991(00) and 991(06). [1959] 184p. 50 refs. AD-228 067.
Order from LC mi$8.40, ph$28.80 PB 149 856

A discussion is presented relevant to the literature, theoretical background, and experimental considerations and techniques pertinent to studies of thermal motions in crystals, particularly AgCl, by means of observations of Bragg intensities. A method for determining temperature factors from temperatures dependences of X-ray intensities is derived. Equipment design and performance, design of experiments, experimental techniques, and characteristics of the specimen are discussed with respect to accuracy and reproducibility.

Harvard U. Div. of Engineering and Applied Physics, Cambridge, Mass.
A THEORETICAL STUDY OF PENDELLÖSUNG FRINGES. PART 1. GENERAL CONSIDERATIONS. PART 2. DETAILED DISCUSSION BASED UPON A SPHERICAL WAVE THEORY, by N. Kato. Technical rept. no. 3 on Contract Nonr-1866(39). 10 Nov 59, 64p. 12 refs. AD-237 681.
Order from LC mi$3.90, ph$10.80 PB 148 320

The assumption of an incident plane wave is shown to be inadequate for single crystal experiments of X-ray diffraction (Laue case). A dynamical theory of diffraction is formulated for a general type of monochromatic incident wave. Fundamental aspects of wave behavior are discussed in terms of wave bundle considerations. Diffraction phenomena are classified by $\Delta\Theta$ (an angular width of single crystal reflection) and Ω_o (a width in which the angular spectrum of an incident coherent wave takes an appreciable value). If $\Delta\Theta' >> \Omega_o$, a plane wave assumption is adequate. This is usually the case for electron diffraction. If $\Delta\Theta << \Omega_o$, a spherical wave assumption is more appropriate and most of X-ray cases fall under this alternative. Furthermore, a criterion is given to distinguish between Fresnel and Fraunhofer diffraction in a crystalline medium. "Pendellösung" fringes of X-rays can be interpreted as Fraunhofer diffraction, while those of electrons are observed in a Fresnel diffraction region. The essential features of section patterns, particularly "hook-shaped" fringes, can now be explained. (Author).

Honeywell Research Center, Hopkins, Minn.
ENVIRONMENTAL EFFECTS ON THE MECHANICAL PROPERTIES OF IONIC SOLIDS WITH PARTICULAR REFERENCE TO THE JOPPE EFFECT, by R. J. Stokes, T. L. Johnston, and C. H. Li. Technical rept. no. 6 on Contract Nonr-2456(00). Oct 59, 26p. 14 refs. HR-59-510; AD-228 082.
Order from LC mi$2.70, ph$4.80 PB 149 870

Mechanical properties of sodium chloride crystals are extremely sensitive to the presence of surface microcracks. Removal of these cracks by immersion in water leads to an enhancement of ductility (10-20% tensile elongation) which is retained indefinitely in dry air providing: (a) the crystal is dried without leaving a surface precipitate, (b) microcracks are not reintroduced by mishandling the gauge length. Storage in a damp atmosphere results in a surface deposit and consequent re-embrittlement. Elimination of surface flaws in other ionic solids does not necessarily result in an enhancement of ductility. Instead, there is a change in fracture behavior which is manifested by a change in the location of fracture origin. The Joffe effect is regarded as the action of a solvent in promoting this change in fracture behavior. Other environmental effects on mechanical properties are distinguished in terms of the type of environment and the initial surface condition. (Author)

Illinois Inst. of Tech., Chicago.
DISTRIBUTION OF ELECTRONS IN CADMIUM SULFIDE CRYSTALS, by Ganesh P. Mohanty and Leonid V. Azaroff. Rept. on Contract AF 49(638)425. 19 July 60, 8p. 5 refs. AFOSR-TN-60-792.
Order from LC mi$1.80, ph$1.80 PB 149 893

The (0001) electron density projections have been determined for a pure CdS crystal having a high dark resistivity and one doped with chlorine having low resistivity. Extremely accurate intensities ($\pm 2\%$) were obtained so that small variations in the electron distribution could be determined. It was found that the atoms in the doped crystal had larger effective sizes than in the undoped crystal. Also, the presence of a very small peak in an interstitial position of the structure suggests that some of the atoms occupy interstitial sites. This result differs markedly from an earlier investigtion by Shuvalov who reports the formation of "electron bridges" between adjacent atoms in CdS crystals having low dark resistivities The results obtained in this investigation also differ from Shuvalov's in regard to variations in diffraction intensities of certain reflections. Possible reasons for these differences are discussed. (Author)

Illinois U., Urbana.
HALL MOBILITY OF HOLES IN SILVER BROMIDE, by Roland Clements Hanson. Doctoral thesis. Technical note no. 4 on Contract AF 49(638)579. June 60, 78p. 90 refs. AFOSR TN-60-795; AD-240 108.
Order from LC mi$4.50, ph$12.30 PB 149 438

Hall mobility measurements have been made on holes introduced into AgBr by a bromine atmosphere in the temperature range from room temperature to 150°C. These measurements were made using conventional electrode geometry and sensitive high impedance a-c techniques similar to those used by Macdonald and Robinson. The Hall mobility for holes varied from 2.0 ± 0.5 cm^2/volt-sec at room temperature (27°C) to 0.5 ± 0.15 cm^2/volt-sec at 150°C. The hole mobility is about 30 times smaller than the electron mobility determined by other workers at room temperature. The temperature dependence of the hole mobility is about T^{-4}. This is much steeper than the temperature dependence of the electron mobility in this region. Preliminary measurements were also made on the thermoelectric power of AgBr in a bromine atmosphere. If the classical theory used is correct, these measurements indicate that the density of states effective mass for the holes is very small. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
VIBRATIONAL THERMODYNAMIC PROPERTIES OF LATTICES WITH DEFECTS. II. TWO- AND THREE-DIMENSIONAL SIMPLE CUBIC LATTICES, by J. Mahanty (Doctoral thesis), A. A. Maradudin, and G. H. Weiss. Rept. on Contracts AF 49(638)399 and AF 18(600)1315. Mar 60, 22p. 7 refs. Technical note BN-198; AFOSR-TN-60-372; AD-235 773.
Order from LC mi$2.70, ph$4.80 PB 148 993

Work is continued and applied to two- and three-dimensional crystals of previously developed methods [J. Mahanty, A. Maradudin, G. Weiss, Prog. Theor. Phys. 20:369, 1958] for the evaluation of the changes in thermodynamic properties of a lattice due to the presence of defects of various kinds. The effects are considered of an isotope defect and a pair of isotope defects on the zero point energy and free energy of two- and three-dimensional cubic lattices. The free energy and self entropy of a vacancy in a three dimensional cubic lattice is evaluated. (Author) (See also PB 135 619)

Institute of Mathematical Sciences, New York U., N. Y.
AN ACCURATE BOUNDARY CONDITION TO REPLACE TRANSITION CONDITIONS AT DIELECTRIC-DIELECTRIC INTERFACES, by Julius Kane and Samuel N. Karp. Rept. on Contract AF 19(604)5238. May 60, 69p. 11 refs. Research rept. no. EM-153; AFCRC-TN-60-391.
Order from LC mi$3.90, ph$10.80 PB 150 033

Most problems involving dielectrics cannot be solved exactly, e.g., diffraction by a dielectric wedge. It is the purpose of this work to describe a technique by which the transition conditions at an interface between two dielectrics can be conveniently and accurately replaced by a single mixed boundary condition.

Institute of Mathematical Sciences, New York U., N. Y.
RADIO PROPAGATION PAST A PAIR OF DIELECTRIC INTERFACES, by Julius Kane and Samuel N. Carp. Rept. on Contract AF 19(604)5238. May 60, 37p. 11 refs. Research rept. no. EM-154; AFCRC-TN-60-392.
Order from LC mi$3.00, ph$6.30 PB 150 054

A previous report introduced a linear boundary condition that serves to accurately replace transition conditions at dielectric-dielectric interfaces. In this work this procedure is applied to obtain an approximate solsolution for an otherwise mathematically intractable problem. The original geometry of the problem is that of a dielectric half space above two dielectric quarter spaces. After the technique of reformulation is applied, the problem reduces to one of obtaining a solution of a two-part boundary value problem, in the upper half space. This problem is solved exactly by the method of Wiener and Hopf. Physically reasonable results are obtained in a form suitable for numerical computation. (Author)

Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.
SOME OPTICAL PROPERTIES OF THE CUPROUS HALIDES AND RELATED COMPOUNDS, by R. Coelho. Rept. on Contract Nonr-1841(10). Oct 59, 35p. 41 refs. Technical rept. 143.
Order from LC mi$3.00, ph$6.30 PB 149 496

The optical absorption spectra of evaporated films of cuprous chloride, bromide, and iodide have been investigated at various temperatures, in an attempt to find how the partial covalence of these compounds affects their optical excitation.

Massachusetts U., Amherst.
ON THE CRYSTALLIZATION OF POLYETHYLENE, by Marion B. Rhodes and Richard S. Stein. Technical rept. no. 15 on Contract Nonr-2151(00). 13 Oct 59, 9p. 6 refs. AD-232 560.
Order from LC mi$1.80, ph$1.80 PB 149 481

A series of light scattering photographs was made on cooling low-density samples from a polyethylene melt having a density of 0.9203 g/cc, a melt index of 2.1, M_n = 23,000, and M_w = 184,000. The photographs were taken with vertically polarized incident light and with a vertically oriented analyzing polaroid between the sample and the photographic film (Vv polarization). The first scattering pattern developing on cooling showed no preferred orientation with respect to the polarization direction, and was characteristic of scattering resulting from density fluctuations. The cooling patterns obtained with a vertically oriented incident polarizer and a horizontally oriented analyzer (Hv polarizer) exhibited polarization which could arise only from anisotropic structure. These pictures showed a gradual increase in intensity with no maximum, which is in agreement with the density fluctuation interpretation of the maximum. A series of Vv photographs obtained on reheating showed no maximum but a gradual decrease in orientation fluctuation type of scattering. The experiments, which are consistent with the proposed 2-stage crystallization mechanism and the proposed origin of the scattering maximum, afford a means for separating and studying the kinetics of the processes.

Massachusetts U., Amherst.
THE SCATTERING OF LIGHT FROM POLYETHYLENE SAMPLES HAVING "RINGED" SPHERULITES. II, by Richard S. Stein and Alphonse Plaza. Technical rept. no. 14 on Contract Nonr-2151(00). 13 Oct 59, 6p. 4 refs. AD-232 559.
Order from LC mi$1.80, ph$1.80 PB 149 480

Materials Research Lab., U. of California, Berkeley.
ORIGIN AND PROPAGATION OF CRACKS IN MAGNESIUM OXIDE SINGLE CRYSTALS, by K. Muray, E. R. Parker, and L. Himmel. Technical rept. no. 1 on Ductile Ceramics Research, Contract AF 49(638)601, ARPA Order 24-59, Task 2. May 60, 30p. 11 refs. AFOSR-TN-60-554; Series no. 150; issue no. 1.
Order from LC mi$2.70, ph$4.80 PB 150 005

Investigations reported herein show that crack nucleation in MgO begins at slip-band intersections where impurities are located in the crystals. Cracks were found to propagate along surfaces containing abnormally high concentrations of impurities. (Author)

Mellon Inst., Pittsburgh, Pa.
INTERMOLECULAR COUPLING OF VIBRATIONS IN MOLECULAR CRYSTALS: A VIBRATIONAL EXCITON APPROACH, by R. M. Hexter. Rept. on Contract AF 49(638)542. 17 Mar 60, 43p. 30 refs. AFOSR-TN-60-325.
Order from LC mi$3.30, ph$7.80 PB 149 830

A vibrational exciton theory is developed which parallels in many ways the electronic exciton theory originally put forward by Davydov and amplified by Craig and Hobbins and by Fox and Schnepp. The kernel of the theory is the adoption of a transition dipole-transition dipole interaction as the potential which perturbs the isolated molecule energies and which thereby couples the motions of pairs of molecules in a crystal. As a result of the quantitative application of this theory, molecular dipole derivatives of several of the parallel modes of methyl chloride are obtained from the correlation field splittings of the corresponding fundamentals in the spectrum of solid methyl chloride. An isotope effect upon correlation field splittings is reported and is accounted for in terms of the same theory.

Mineralogical Lab., U. of Michigan, Ann Arbor.
ULTRAVIOLET PIEZOBIREFRINGENCE OF DIAMOND, by Malcolm Alvin Conrad. Research supported by ONR Contract. 1959, 56p. 31 refs.
Order from LC mi$3.60, ph$9.30 PB 149 855

Measurements of optical properties aid the development of the theory of solid state physics. The importance of stress-optical investigations is augmented by the close association of stress-optical, piezoelectric, and electro-optical properties. With few exceptions, stress-optical studies have been confined to the visible portion of the spectrum. The purpose of this study is to extend these limits by measurement of the piezobirefringence constants of diamond to its transmission limit in the ultraviolet portion of the spectrum.

New York U., N. Y.
PARAMAGNETIC RESONANCE IN THE SOLID STATE, by Hartmutt Kallmann. Quarterly progress rept. no. 5, July-Sep 59, on Contract DA 36-039-sc-78056. Oct 59, 8p. AD-229 083.
Order from LC mi$1.80, ph$1.80 PB 150 588

This report released for sale to the public 13 Oct 60.

An analog integrator for the automatic recording of EPR absorption spectra is described in detail. This accessory to the Varian spectrometer makes it possible to compare the spectra of standard samples with unknown spectra to obtain the number of unpaired electron spins in the unknown. The integrator also facilitates the measurement of line widths and line separations. An experiment on the effect of β radiation on the benzene-carbon tetrachloride system was set up. Diphenylpicrylhydrazyl is used as a scavenger for radicals produced. A copper activated zinc sulfide phosphor was examined for trapped electrons by electron paramagnetic resonance. When the phosphor was excited by blue light at room temperature a concentration of about 10^{16} electrons per cm^3 was calculated after comparison with diphenylpicrylhydrazyl. In the dark, the number of trapped electrons decays to about half the initial number in 18 hours. (Author) (See also PB 147 941)

Northwestern Technological Inst., Evanston, Ill.
TRANSFORMATION STUDIES OF GRAY TIN SINGLE CRYSTALS, by R. G. Wolfson, M. E. Fine, and A. W. Ewald. Rept. on Contract AF 49(638)524. June 60, 15p. 5 refs. AFOSR-TN-60-794.
Order from LC mi$2.40, ph$3.30 PB 150 105

Measurements of the linear growth rate of white tin into thin single-crystal wafers of gray tin, over the temperature range 24.2 to 46.5°C, are presented. The rate is not a single-valued function of the temperature. Imposed upon the strong temperature dependence of the average rate is a variation which is well defined at a given temperature; the spread in the observed values decreases sharply with increasing temperature. The variation is attributed to two observed stress-relaxation processes: cleavage in the gray tin and plastic deformation accompanied by recrystallization in the white tin. (Author)

Ohio State U. Research Foundation, Columbus.
RESEARCH ON SOLID-STATE PROPERTIES OF METALLIC CERAMIC AND ELECTRONIC MATERIALS, by P. M. Harris. Final rept. on Contract AF 18(600)769. Sep 59, 10p. AFOSR-TR-59-[109].
Order from LC mi$1.80, ph$1.80 PB 152 014

This report released for sale to the public 13 Oct 60.

Contents:
Charge distribution and characteristic temperature of metallic lithium from x-ray scattering at 300° and 100°K.
An investigation of the transformation and structure of silver mercuric iodide
Laue-Bragg scattering and charge distribution in lithium hydride

Raytheon Co., Waltham, Mass.
INVESTIGATION OF THE MICROWAVE PROPERTIES OF FERROELECTRICS, by Georg Rupprecht. Scientific rept. no. 1 on Contract AF 19(604)4085. June 60, 36p. AFCRC-TN-60-595.
Order from LC mi$3.00, ph$6.30 PB 149 905

Newly developed measuring techniques are described which make it possible to measure the complex dielectric constant of ferroelectric material over a wide range of temperatures and frequencies. At the same time, non-linear behavior can be studied. Strontium titanate single crystals have been measured in the temperature range from 80°K to about room temperature and over a frequency range from 100 c/sec to 24 kMc/sec. The essential result of these experiments is that there is no dispersion of the dielectric constant

up to K-band frequencies and a relation exists between the change of the dielectric constant above the Curie temperature as a function of external electric field and temperature. The dependence of the non-linear effect on the crystal orientation has been investigated. An interpretation of these results along the lines of Slater's theory of ferroelectricity in perovskite structures gives a qualitative but not a quantitative agreement. X-ray studies on $SrTiO_3$ single crystals are described, which also shed some doubt on the basic assumptions of Slater's theory. (Author)

Research Chemicals, Burbank, Calif.
PELTIER EFFECTS FOR CRYSTAL GROWING, by Louis L. Thomas. Rept. for Dec 58-Nov 59 on Electrical and Electronic Materials, Contract AF AF 33(616)6150. May 60, 52p. 10 refs. WADD Technical rept. 60-17.
Order from OTS $1.50 PB 161 985

Available literature on crystal growing and refining processes has been reviewed. In accordance with the results of the literature survey and analysis of the problem, the zone melting technique has been chosen for modification to study the potential of the Peltier effect for improving crystal properties. Zone melting apparatus, modified according to the criteria developed, has been fabricated. Germanium rods have been zone melted. Concurrent experimental work included measurement of resistivity, Hall effect, magneto-Seebeck effect at the melting point, and Peltier effect as applied to zone melting. (Author)

Rome U. (Italy).
CHEMISORPTION AND CATALYSIS ON OXIDE SEMICONDUCTORS, by V. Caglioti, A. Cimino and others. Final technical rept. no. 2, 1 Feb 59-31 Jan 60, on Contract DA 91-591-EUC-1057. 27 Feb 60, 57p. 29 refs.
Order from LC mi$3.60, ph$9.30 PB 149 448

Chemisorption of hydrogen on ZnO (powder samples), with and without the addition of Li^+ or Ga^{3+} has been investigated in the temperature range -80° to 350°C, and at pressures between 70 and 715 torr. The electrical conductivity of powdered samples of pure ZnO has been studied as a function of the temperature and of the hydrogen pressure. A model for chemisorption is postulated. According to this model the quasi-free electrons present in ZnO can initiate the chemisorption process. The heat evolved during adsorption may in part be utilized to excite new electrons, which become available for chemisorption (site creation). Another fraction of the heat is utilized for the desorption, a process which also sets in immediately. The observed chemisorption therefore depends on the rate of excitation and of decay of electrons, and on the desorption process. Electrical conductivity measurements on doped samples are presented. An enhancement of conductivity was found which, as for pure ZnO, is more marked at higher temperatures. Photoconductivity (u. v. irradiation) experiments on sintered ZnO pellets were performed at hydrogen pressures of 2 or 25 torr, in the temperature range 30° to 300°C. A decrease of the photo-effect is observed in the presence of hydrogen.

Stanford Electronics Labs., Stanford U., Calif.
ANALYTICAL TECHNIQUE FOR OPTIMIZING THE HALL EFFECT, by G. M. Krembs. Rept. on Contract Nonr-225(31). 15 Oct 59, 94p. 46 refs. Technical rept. no. 1702-2; AD-228 792.
Order from LC mi$5.40, ph$15.30 PB 149 492

Study is made of signal levels and noise in the Hall effect as a function of the material constants, the geometrical configuration, and the ambient and the operating conditions. An analytical technique is desired for determining the optimum values of these parameters whenever the Hall effect application requires either a large Hall voltage per unit of magnetic field strength or a good signal-to-noise ratio. The major results of this study can be summarized as follows: (1) from a thermal analysis of the signal level in a Hall device mounted on a simple heat-sink structure it is shown that there exists an optimum crystal temperature at which the Hall voltage is a maximum; (2) since no material exists with all the ideal properties desired for a Hall generator, the proper choice of available materials is found to depend strongly on the temperature of the environment; (3) the power spectrum for the noise sources in the Hall device is demonstrated by means of a theoretical analysis of the Hall voltage as a function of the fluctuating charge density to be proportional to the spectrum for the current noise, where the value of this proportionality constant is determined as a function of the material parameters and other variables; and (4) the signal-to-noise ratio, formulated from the investigations of the signal level and Hall noise spectrum, is shown to have an optimum temperature which differs from the maximum signal condition, and to approach a constant value with increasing magnetic field strength, provided the misalignment noise is negligible. (Author)

Stanford U., Calif.
PROTON RESONANCE SHIFTS IN DIPHENYL PICRYL HYDRAZYL, by M. E. Anderson, G. E. Pake, and T. R. Tuttle, Jr. Rept. on Paramagnetic Resonance, Contract AF 18(603)131. July 60, 9p. 6 refs. Technical note no. 131-7; AFOSR-TN-60-736.
Order from LC mi$1.80, ph$1.80 PB 150 377

This note reports experiments in the temperature range between 4.2°K and 1.4°K in which a number of components are clearly resolved and the 1/T dependence of these shifts is clearly exhibited. In addition, the first of a series of deuterium substitution experiments has permitted explicit identification of one of the shifted components.

Uppsala U. (Sweden).
THE STRUCTURES OF Co_2P, Ru_2P AND RELATED PHASES, by Stig Rundqvist. Technical note no. 12 on Contract AF 61(052)40. 4 May 60, 38p. 35 refs. AFOSR-TN-60-338; AD-240 307.
Order from LC mi$3.00, ph$6.30 PB 149 581

The crystal structures of Co_2P and Ru_2P have been refined using single-crystal methods. Both phosphides crystallize in the C 23 structure type. A structural comparison with related phosphides and silicides is given. Co_2P has an extended homogeneity range at higher temperatures, the phosphorus-rich limit at 1000°C corresponds to the formula $Co_{1.94}P$.

There are evidences that the widening of the homogeneity range is connected with random vacancies on metal atom sites. This paper gives an account of single-crystal structure determinations of Co_2P and Ru_2P. Some phase-analytical data for the binary Co_2P and Ru_2P, and the ternary $Co_2(P, Si)$ phases are also reported and discussed. (Author)

Uppsala U. (Sweden).
THE TERNARY COMPOUND $SbCl_5 \cdot TiCl_4 \cdot 3POCl_3$, by Göran Adolfsson, Ragnar Bryntse, and Ingvar Lindqvist. Technical note no. 11 on Contract AF 61(052)43. 1 Apr 60, 4p. 2 refs. AFOSR-TN-60-192; AD-240 308.
Order from LC mi$1.80, ph$1.80 PB 149 579

Utah U., Salt Lake City.
AMBIENT HISTORY DEPENDENCE IN THE ELECTRICAL RESISTANCE OF CORUNDUM, by R. N. Tucker and P. Gibbs. Technical rept. no. 11 on Contract Nonr-1288(03). 15 Oct 59, 34p. 7 refs. AD-231 183.
Order from LC mi$3.00, ph$6.30 PB 149 475

The conduction current of single-crystal α-Al_2O_3 was measured over the temperature range 200°C to 900°C. It was observed that the conduction current was strongly dependent upon both the environmental history and the dislocation structure of the sample. Boiling the samples for one hour in various aqueous solutions [6-N HCl, $Mg(NO_3)_2$] and NaCl lead to significant increases in the conduction current as compared to samples which had been cleaned by heating at 1000°C in N. In each of the controlled contamination cases, the conduction current passed through a maximum: for HCl-contamination, the maximum occurred at about 350°C; for $Mg(NO_3)_2$-contamination, at about 570°C; and for NaCl-contamination, at about 705°C. The maxima were sharply followed by pulses in the conduction current, the frequency of which were observed to be sensitive to external mechanical vibrations. The pulses and maxima were absent upon cooling from 1000°C or reheating the cleaned crystal in a dry N atmosphere. Conduction current measurements were made on deformed samples, both parallel and transverse to the bend-induced dislocation structure. The parallel, contaminated conduction current showed a more than ten-fold increase over the other cases. (Author)

Wayne State U., Detroit, Mich.
PREPARATION OF LARGE AREA SINGLE CRYSTAL CUPROUS OXIDE AND THE ELECTRICAL CONDUCTIVITY OF SINGLE CRYSTAL CUPROUS OXIDE AT HIGH TEMPERATURES, by Robert S. Toth, Rein Kilkson, and Dan Trivich. Technical rept. no. 2 on Contract AF 18(600)481. 30 Apr 60, 97p. 51 refs. AFOSR-TN-60-485.
Order from LC mi$5.40, ph$15.30 PB 149 759

A method has been developed for the preparation of single crystals of cuprous oxide in the form of thin sheets of large area. The cuprous oxide was prepared initially in polycrystalline form by oxidation of copper sheet in air at temperatures below 1050°C. Subsequent annealing of the polycrystalline cuprous oxide sheet at higher temperatures, from 1070 to 1130°C, caused the grains to grow to large size, frequently attaining sizes of greater than a square inch in area. The process for preparing single crystal cuprous oxide was effective only on thin sheets, less than 0.060" thick. The single crystal character of the large grains was verified by X-ray examination, which further showed that the crystals were not strained and that preferred orientations of [211] and [311] existed. The electrical conductivity of the single crystal cuprous oxide was measured in the temperature range of 1100°C to 500°C at oxygen pressures from 152 mm to 10^{-5} mm. The plot of the logarithm of the conductivity against the logarithm of the oxygen pressure at constant temperature was found to be linear over a pressure range of 50 mm to 10^{-2} mm, with a slope of 0.1420 (approximately 1/7). The curve departs from linearity at lower pressures and also goes through a minimum with decreasing pressure. The activation energies, obtained from the straight line plots of the logarithm of the conductivity against the reciprocal of the absolute temperature, gave essentially constant values of 0.65 ev. at oxygen pressures from 50 mm to 10^{-2} mm. At pressures of 10^{-3} and 10^{-4} mm., the activation energy increased sharply to 1.05 ev. The conductivity in air at temperatures of 1020° to 1100°C gave an activation energy of 0.767 ev.

Wayne State U., Detroit, Mich.
THE PROPERTIES OF ELECTROLYTICALLY PREPARED CUPROUS OXIDE AND THE EFFECT OF SULFIDING ON THE PROPERTIES OF CUPROUS OXIDE PHOTOVOLTAIC CELLS, by Robert S. Toth, Nicolaos Economou, and Dab Trivich. Technical rept. no. 3 on Contract AF 18(600)481. 30 Apr 60, 50p. 31 refs. AFOSR-TN-60-725.
Order from LC mi$3.30, ph$7.80 PB 149 760

A method of preparing thin films of Cu_2O by an electrodeposition technique has been developed for the study of these films. The basic properties of these films differ only slightly from results on thermally prepared Cu_2O except that water has been found to be incorporated in the deposit. This can be eliminated by annealing at a proper temperature. The sulfide treatment of the Cu_2O surface of a copper oxide photovoltaic cell has been found to affect only slightly the output of thermally prepared cells. Sulfiding on electrolytically prepared cells was found to increase the power output by a factor of 10^2 to 10^3. The reason for the increased output is the lowering of the series resistance of the cells by the sulfide layer and a consequent increase in the efficiency of collection of the carriers produced at the photosensitive junction. This effect is larger for high resistance electrolytic Cu_2O than for the lower resistance thermal Cu_2O. The effect of the sulfiding treatment on the photovoltaic output can be maximized by proper selection of sulfide layer thickness and geometry of the top contact. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
INVERSION BY FAST PASSAGE IN A MULTILEVEL SYSTEM [AND] ELECTRON PARAMAGNETIC RESONANCE IN SEMICONDUCTING RUTILE, by P. E. Wagner, P. F. Chester and others. Quarterly rept. on Contract AF 19(604)5589. 14 Apr 60, 19p. 7 refs. Research rept. 403FD449-R5; ERD-TN-60-755.
Order from LC mi$2.40, ph$3.30 PB 149 812

Observations of Cr^{+++} resonances in ruby following adiabatic fast passage show inversion of the 2-4 transition when fast passage is applied to the 2-3 and 3-4 transitions, but only when the 2-3 and 3-4 transitions coincide during fast passage. Analysis is given for the inversion requirements in the two cases: sequential passage, as proposed by Siegman and Morris, and coincident passage. Electron paramagnetic resonance has been observed in oxygen deficient rutile at helium temperatures. The paramagnetic center is discussed in terms of Ti^{+++} associated with certain oxygen vacancies. The study is continuing. (Author)

Westinghouse Research Labs., Pittsburgh, Pa.
MAGNETO-OPTICAL EFFECTS IN FERRIMAGNETIC OXIDES, by P. C. Bailey and A. Goldman. Final rept. for 15 Mar 59-15 Mar 60 on Contract AF 19(604)552. [1960] 85p. 30 refs. AFCRC-TR-60-147.
Order from LC mi$4.80, ph$13.80 PB 149 572

The optical properties of thin transparent sections of many of the rare earth garnets and orthoferrites were investigated. Single crystals grown for this purpose were the garnets of yttrium and the rare earths from samarium to europium, and the corresponding orthoferrites. In addition, crystals of α-Fe_2O_3 were grown and investigated. The properties studied included optical absorption, Faraday rotation, reflectivity, circular dichroism and magnetic birefringence. Measurements were made at room and liquid nitrogen temperatures in the visible and infra-red (1-25μ) region, and the results correlated with existing theories. The absorption and rotation of all the garnets were similar with anomalies present in the cases of dysprosium, erbium, thulium and ytterbium. (Author)

Willow Run Labs., U. of Michigan, Ann Arbor.
EXCITON AND MAGNETO-OPTICAL EFFECT IN STRAINED AND UNSTRAINED GERMANIUM, by David F. Edwards and Vito J. Lazazzera. Rept. on Proj. Michigan, Contract DA 36-039-sc-78801. Aug 60, 17p. 14 refs. 2900-197-R.
Order from LC mi$2.40, ph$3.30 PB 150 183

Measurements have been made of the direct-transition magneto-optical effect in strained and unstrained germanium at 77°K. The results indicate that the absorption peaks correspond to transitions to exciton levels associated with each Landau level in qualitative agreement with the theoretical calculations of Loudon (The Theory of the Absorption Edge in Semiconductors, unpublished doctoral dissertation, Oxford University, 1959) and of Howard and Hasegawa (Bull. Am. Phys. Soc., 1960, Ser. II, vol. 5, p. 178). (Author)

Theoretical Physics

Air Force Cambridge Research Center, Bedford, Mass.
THE IMPORTANCE OF THE FOURTH STATE OF MATTER TO THE MISSION OF THE AIR FORCE, by Lawrence C. Mansur. Jan 60, 20p. 37 refs. AFCRC-TN-60-137; AD-235 257.
Order from LC mi$2.40, ph$3.30 PB 147 882

A discussion is presented of the reasons for the intense interest in plasma or gaseous physics. A brief resume of the history since Langmuir is presented. The physical and electrical characteristics are discussed as are the proposed and existing uses of a plasma as a power generator, as a generator of electromagnetic radiation, as a material, as an electronic device, and as a sometimes helpful and sometimes hindering environment. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
ON THE DECAY OF PLANE SHOCK WAVES, by S. Chandrasekhar. 8 Nov 43, 14p. Rept. no. 423.
Order from LC mi$2.40, ph$3.30 PB 150 453

This report released for sale to the public 11 Oct 60.

The problem of the decay of plane shock waves is considered and it is shown that there exists a special class of shock pulses for which the problem of decay admits of an explicit solution. The case in question arises when shocks of moderate intensities (Mach numbers less than 1.5 if an accuracy of one per cent is demanded) are considered. In these cases the changes in entropy as well as in the quantity 5 c - u (where c denotes the local velocity of sound and u the mass velocity) as the shock front is crossed can be neglected. The case of linear shock pulses in which both u and c are linear functions of x behind the shock front is considered particularly in some detail.

Cambridge U. (Gt. Brit.)
A DISCUSSION OF DUAL DIAGRAMS IN PERTURBATION THEORY, by P. V. Landshoff. Technical scientific note no. 8 on Contract AF 61(052)233. May 60, 11p. 9 refs. AFOSR-TN-60-729.
Order from LC mi$2.40, ph$3.30 PB 150 343

A discussion is given of the dual diagram method of finding singularities corresponding to a contribution to the S-matrix from a Feynman graph in perturbation theory. It is shown that it may be necessary to draw the dual diagram in a space of greater dimensions than that spanned by the external momentum vectors of the Feynman graph, but that this possibility does not affect previous conclusions concerning anomalous thresholds in vertex parts. The effects are considered of the dimensionality of space on the singularities for processes involving many external particles. (Author)

Cambridge U. (Gt. Brit.)
SOME PROPERTIES OF SINGLE LOOP DIAGRAMS IN PERTURBATION THEORY, by M. Fowler, P. V. Landshoff, and R. W. Lardner. Technical scientific note no. 7 on Contract AF 61(052)233. May 60, 11p. 6 refs. AFOSR-TN-60-728.
Order from LC mi$2.40, ph$3.30 PB 150 342

Methods are summarized for finding singularities of a contribution to the S-matrix for a Feynman diagram in perturbation theory, with particular reference to single-loop diagrams. They are then applied to the third order vertex function and to an extension of the work of Tarski on scattering in fourth order, with internal stability conditions relaxed. The results for the vertex function are used to show that the S-matrix for production processes does not have a two-variable spectral representation. Finally it is shown that the leading singularities for the fifth order contribution to single pion-production in π-N scattering do not produce anomalous thresholds. (Author)

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
IRREVERSIBILITY IN INTERACTING SPIN SYSTEMS, by J. Philippot. Rept. on Contract AF 18(600)1315. Mar 60, 16p. 14 refs. Technical note BN-200; AFOSR-TN-60-346; AD-235 772.
Order from LC mi$2.40, ph$3.30 PB 148 995

A system whose hamiltonian is split into two terms $H = H_0 + \lambda V$ exhibits two types of irreversible processes. The first processes are described by the unperturbed hamiltonian, H_0, only. The second processes, which result from the perturbation, lead to an increase of the entropy of the system. These processes are illustrated by the examples of free precession and cross relaxation. General formula are given for transition probabilities. The expressions applied to cross relaxation in lithium fluoride agree with the results obtained by Bloembergen (Physica 15:410, 1949) and Pershan.

Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park.
ON VAN HOVE'S DIAGONAL SINGULARITY CONDITION, by J. Philippot. Rept. on Contract AF 18(600)1315. Mar 60, 13p. 4 refs. Technical note BN-199; AFOSR-TN-60-344; AD-235 770.
Order from LC mi$2.40, ph$3.30 PB 148 994

The diagonal singularity property of Van Hove (Physica 21:517, 1955; 23:441, 1957, 25:268, 1959) is shown not to be represented by a singularity of the δ type in the many body systems of interacting particles or phonons. This property is verified in certain scattering problems, and is a consequence of the random distribution of the scattering centers.

Institute of Field Physics, U. of North Carolina, Chapel Hill.
THE "MEASURE" IN THE FEYNMAN QUANTIZATION OF GENERAL RELATIVITY, by Bryce S. DeWitt. Rept. on Contract Nonr-855(07). Oct 59, 8p. 4 refs. Publication no. 5.
Order from LC mi$1.80, ph$1.80 PB 149 879

Institute of Mathematical Sciences, New York U., N. Y.
MAGNETO-HYDRODYNAMICS. Final rept. on Contract AF 19(604)2138. Dec 59, 15p. 10 refs. AFCRC-TR-60-224; AD-236 066.
Order from LC mi$2.40, ph$3.30 PB 148 990

Studies and mathematical investigations were conducted on the motion of charged particles of an ionized fluid in the presence of external electric and magnetic fields, with particular applications to motions in the ionized layers of the atmosphere and to the influences such motions have on the geomagnetic field at or near the earth's surface. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
THE DECAY $\Sigma^0 \rightarrow \Lambda^0 + e^+ + e^-$ AND THE $\Sigma^0 - \Lambda^0$ RELATIVE PARITY, by Nina Byers. Technical note no. 22 on Contract AF 49(638)388. July 60, 13p. 7 refs. Technical Note 388-22; AFOSR-TN-60-769.
Order from LC mi$2.40, ph$3.30 PB 149 577

Institute of Theoretical Physics, Stanford, U., Calif.
GROUND STATE OF ODD-ODD NUCLEI, by A. deShalit and J. D. Walecka. Technical note no. 23 on Contract AF 49(638)388. July 60, 12p. 8 refs. Stanford technical note 388-23; AFOSR-TN-60-837.
Order from LC mi$2.40, ph$3.30 PB 149 798

Institute of Theoretical Physics, Stanford U., Calif.
HIGH-FREQUENCY REGION OF THE BREMSSTRAHLUNG SPECTRUM, by R. H. Pratt. Technical note no. 21 on Contract AF 49(639)388. July 60, 27p. 22 refs. Stanford technical note 388-21; AFOSR-TN-60-823.
Order from LC mi$2.70, ph$4.80 PB 149 797

The McVoy-Fano theory of the connection between the atomic photoelectric effect and the high-frequency region of the Bremsstrahlung spectrum has been extended to next order in αZ. The contribution from P states is determined and is important in heavy elements. Predictions for the high-frequency limit are in reasonable agreement with experiment. Information is also obtained concerning angular distributions and polarization correlations. (Author)

Institute of Theoretical Physics, Stanford U., Calif.
OBSERVATION OF $\pi - \pi$ RESONANCE IN PION PRODUCTION, by S. D. Drell and F. Zachariasen. Technical note no. 20 on Contract AF 49(638)388. June 60, 12p. 6 refs. Technical note 388-20; AFOSR-TN-60-645.
Order from LC mi$2.40, ph$3.30 PB 149 576

Maryland U., College Park.
ON THE ANALYTIC PROPERTIES OF THE 4-POINT FUNCTION IN PERTURBATION THEORY, by Alfred Chi-Tai Wu. Rept. on Contract AF 49(638)24. July 60, 144p. 30 refs. Physics Dept. technical rept. no. 186; [AFOSR] TN-60-804.
Order from LC mi$7.20, ph$22.80 PB 149 539

Contents:
Simple examples of the 4-point functions
Function of six complex variables represented by a 4-fold Feynman parameter integral
Sources of singularities of the 4-point function
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Explicit form of the 4-point function
Partially differentiated form
The 3-point roots
Envelope problem for the Φ-manifold
Some algebraic details for the 4-mass envelope
Note on the determinant expansion

Maryland U., College Park.
QUASI-PARTICLE APPROACH TO INTERACTION IN AN IDEALIZED METAL, by John J. Quinn and Richard A. Ferrell. Rept. on Contracts Nonr-1797(00) and AF 49(638)399. Sep 59, 25p. 17 refs. Physics Dept. technical rept. no. 156; AD-229 342.
Order from LC mi$2.70, ph$4.80 PB 148 890

The properties of a degenerate electron gas with a background of positive charge capable of propagating phonons are studied by means of a quasi-partical approach. The ground state of the system is pictured as a vacuum state, and any additional particles or holes together with their polarization clouds are thought of as quasi-particles. The Coulomb repulsion and the effective electron-electron attraction due to phonon exchange are treated separately. The specific heat, spin susceptibility, and compressibility are determined in terms of the effective energy of interaction $V_{pp'}$ of two quasi-particles. Considering only the lowest order process contributing to $V_{pp'}$ reproduces known results for the high density limit Coulomb correction to specific heat and spin susceptibility, but gives a new result for the phonon correction. To lowest order, the electron-phonon interaction produces no change in the spin susceptibility, in contrast to general expectation. For real metallic densities higher order graphs must be included; however for this case it may be possible to choose $V_{pp'}$ empirically. (Author)

Maryland U., College Park.
STRICT LOCALIZATION IN QUANTUM FIELD THEORY, by James Milton Knight. Doctoral thesis. Rept. on Contract AF 49(638)24. July 60, 55p. 15 refs. Physics Dept. technical rept. no. 187; AFOSR-TN-60-818.
Order from LC mi$3.60, ph$9.30 PB 149 835

A definition of strict localization of states in quantum field theory is presented. This definition is based on considering products of field operators as the primary measurable quantities of the theory. An example of a localized state is given, showing that such a state arises when a free field interacts with an external current that is limited to a bounded region of space-time. It is shown by means of a graphical technique that a state having a finite number of particles cannot satisfy the definition of localization. A simple representation of localized states is investigated, and arguments are given to support its generality and uniqueness. (Author)

Microwave Lab., Stanford U., Calif.
INVESTIGATION OF MICROWAVE PROPERTIES OF PLASMAS. Scientific rept. no. 8, 1 Feb-30 Apr 60, on Contract AF 19(604)5226. May 60, 16p. M. L. rept. 725; AFCRC TN-60-590.
Order from LC mi$2.40, ph$3.30 PB 150 376

A cesium plasma with a high percentage of ionization has been obtained, and measurements were consistently repeatable over long long periods of time. The characteristics of density and impedance of the ionized plasma are discussed. Various possible noise measurement experiments have been examined. The experimental apparatus for generating harmonics has been built. Some aspects of the apparatus and some early experiements with the apparatus are discussed. Theoretical analysis is continuing and an equation for the case of no magnetic field has been derived. A better theoretical understanding has been obtained of the requirements necessary for improved parametric gain. Three basic requirements are discussed. Some low frequency properties of hot cathode mercury vapor discharge tubes are now being investigated. A new discharge tube has been used to determine the effect of frequency upon the sheath interaction. These findings were studied and interpreted. The role of temperature in the theory of nonlinear effects in plasma is reviewed. (Author) (See also PB 148 168).

Microwave Physics Lab., Sylvania Electric Products, Inc., Mountain View, Calif.
ENERGY TRANSFER IN PLASMAS. Technical note no. 5 on Contract AF 30(602)2050. 23 May 60, 19p. 3 refs. RADC TN-60-124.
Order from LC mi$2.40, ph$3.30 PB 149 299

A continuation of the mathematical analysis of microwave propagation in a non-uniform plasma, in which the confluent hypergeometric function approximation is discussed, is presented. Anomalous high absorption of microwaves in helium gas excited at one boundary by microwave radiation at cyclotron frequency has been observed. The addition of small amounts of argon caused this absorption to decrease, indicating that the cause for the high absorption may be in the unusually large population of excited states produced at the hot boundary. Similar experiments are being conducted with air. Experimental designs for the study of non-uniform plasmas and for plasma-acoustical experiment are described. (Author)

Microwave Lab., Stanford U., Calif.
MILLIMETER WAVE GENERATION AND AMPLIFICATION IN PLASMAS, by G. S. Kino. Scientific rept. no. 6 on Contract AF 19(604)5226. Dec 59, 24p. 14 refs. M. L. Rept. no. 676; AFCRC-TN-60-114; AD-234 973.
Order from LC mi$2.70, ph$4.80 PB 147 884

A review of two possibilities for millimeter wave generation in a gas discharge plasma is given. The encouraging experimental results obtained so far with harmonic conversion in a plasma are discussed, and the nonlinear effects are explained in terms of a simple zero temperature theory. The amplification which occurs when an electron beam passes through a plasma is discussed in the light of millimeter wave

applications. The use of sound waves in a plasma to set up an artificial periodic system in the plasma is described as a possible way in which the coupling problem may be solved.

Oxford U. (Gt. Brit.)
TRANSVERSE COMPRESSION WAVES IN A 'STABILISED' DISCHARGE, by Daryl Reagan. Technical note no. 4 on Contract AF 61(514)1183. [1960] 15p. 8 refs. AFOSR-TN-60-279; AD-234 220.
Order from LC mi$2.40, ph$3.30 PB 147 620

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
LONGITUDINAL ION OSCILLATIONS IN HOT PLASMA, by Burton D. Fried and Roy W. Gould. 28 June 60, 37p. 12 refs. STL/TR-60-0000-GR185.
Order from LC mi$3.00, ph$6.30 PB 150 278

The linearized, longitudinal waves in a hot plasma include, besides the familiar electron plasma oscillations (epo), ion plasma oscillations (ipo) with $\omega \approx \omega_p(m/M)^{1/2}$. The properties of these ipo are explored using a Vlasov equation description of the plasma.

Scuola di Perfezionamento in Fisica Teorica e Nucleare, Naples (Italy).
FINAL TECHNICAL REPORT. Rept. for 1 May 59-31 July 60, on Contract DA 91-591-EUC-1096.
Order from LC mi$1.80, ph$1.80 PB 150 373

The main results of the two-year research reported here are: (1) a consistent formulation of field theory, totally rid of ambiguities and infinities, susceptible of exact mathematical treatment, (2) the proof that the ultraviolet divergences are eliminated correctly by an appropriate re-definition of the concept of integral, such as is imposed by the hyperbolic nature of the field equations. As a by-product one obtains the Lie equations of the renormalization group: these, tested on the Lee model, have given the expected answers, (3) a similar procedure permits to factor out, in a rigorous and perturbation-independent manner, the infrared divergences of electrodynamics, yielding a strict and very simple proof of the conjecture of many authors on this subject. (Author).

Syracuse U., N. Y.
THE CONSTRUCTION AND PROPERTIES OF NON-EQUILIBRIUM GIBBSIAN ENSEMBLES, by Robert L. W. Chen. Rept. on Contract AF 49(638)461. July 60, 33p. 7 refs. AFOSR[TN]60-746.
Order from LC mi$3.00, ph$6.30 PB 149 872

The methods of constructing Gibbsian ensembles are discussed for isolated systems undergoing irreversible processes and then the properties of these ensembles are examined in detail. Different kinds of physical situations call for different types of representative ensembles. In particular, situations are contrasted in which: (1) the system is just beginning an irreversible process, and (2) the system has had some uninterrupted past history. These basic considerations would enable one to resolve some apparent contradictions described in current literatures. (Author)

Syracuse U., N. Y.
A STATIONARY GIBBSIAN ENSEMBLE, by Walter Louis Sadowski. Rept. on Contract AF 49(638)461. July 60, 54p. 8 refs. AFOSR-TN-60-824.
Order from LC mi$3.60, ph$9.30 PB 149 885

The Bergmann-Lebowitz equation is derived by integrating the Liouville equation over domains of collision of system particles with those of the reservoir. On the basis of a specific physical model the stationary non-equilibrium distribution function is investigated. The kernel of the non-equilibrium problem is expanded in a power series of the temperature difference across the system. The expansion obtained contains the temperatures of the two reservoirs in the zeroth-order of the distribution function. The resulting zeroth-order distribution function contains numerical factors which make it slightly different from the equilibrium distribution. The physical significance of these factors is discussed. A specific property of the perturbative kernel is used to find the approximate solution to the first-order perturbative equation. The one-particle distribution function in μ-space is obtained by integrating the first-order n-particle distribution function.

Technical Research Group, Inc., Syosset, N. Y.
THE EFFECTS OF A PLASMA SHEATH ON THE IMPEDANCE PROPERTIES OF SOME SLOT ANTENNAS. PART I. ANALYTICAL FORMULATION, by Sylven Cutler. Scientific rept. no. 1 on Contract AF 19(604)4574, SA no. 1. Dec 59, 32p. 12 refs. TRG-127-SR-1; AFCRC-TN-59-993; AD-234 593.
Order from LC mi$3.00, ph$6.30 PB 147 885

The impedance properties of a slot antenna radiating into a plasma layer in space are obtained by determining the equivalent admittance of a slot radiating into a layer of complex refractive index. The equations are derived which give the equivalent admittance for a simplified problem whose solution can be used to obtain the impedance properties for practical antennas. The simplified problem consists of a single slot formed by the open end of a waveguide radiating into the layer of complex refractive index in a planar half space. The admittance is given in a variational expression in terms of the slot field. (Author)

Vienna U. (Austria)
THE CONFORMAL INVARIANCE IN QUANTUM FIELD THEORY, by J. Wess. Scientific note no. 6 on Contract AF 61(052)265. 20 June 60, 26p. 8 refs. AFOSR-TN-60-1003.
Order from LC mi$2.70, ph$4.80 PB 150 358

The properties of a conformal invariant quantum field theory are considered. A short discussion of the conformal group in four dimensions and of the topology, introduced into the pseudo-euclidean space by this group, is given. With the help of the commutation relations the spectrum of the generators in the Hilbert-space is investigated. The only possible discrete eigenvalue of P^2 and of the P^ν's is zero and the generator for scale transformations S has a continuous spectrum. The eigenfunctions of S in the x-representation are calculated; they form a complete set. The conservation laws valid in an invariant theory and the commutation relations predict a certain form of the conserved quantities expressed in terms of the energy-momentum tensor and

of the coordinates. For scalar, spinor and vector fields the generators are derived by the action principle of Schwinger. (Author).

Weizmann Inst. of Science (Israel).
MANY BODY PERTURBATION METHODS IN SOLUBLE MODEL, by Amnon Katz. Technical note. no. 2 on Contract AF 61(052)337. 1 Mar 60, 54p. 18 refs. AFOSR-TN-60-802.
Order from LC mi$3.60, ph$9.30 PB 150 041

It is pointed out that because statistics should not be obeyed in Goldstone's perturbation expansion there exist two-body contributions from diagrams other than ladders. The role of diagrams with "wrong" statistics is investigated in a model in which the perturbation is a single particle potential. A summation of all diagrams is carried out in this model and compared to the sum of all ladders. It is found that the "wrong statistics" contributions are important in deciding the region of convergence of the series and the location and nature of the singularities which limit it. In the case of two-body interactions with short range and low density the most important contributions with wrong statistics are the two-body contributions of "many body diagrams". Their inclusion is equivalent to using the Cooper type solution of a Bethe Goldstone equation.

Thermodynamics

Applied Physics Lab., Johns Hopkins U., Silver Spring, Md.
COLLISION INTEGRALS FOR SPHERICALLY SYMMETRIC MOLECULES INTERACTING WITH AN EXPONENTIAL REPULSIVE POTENTIAL, by Louis Monchick. Rept. on Contract NOrd-7386. July 59, 26p. 13 refs. CM-956; AD-225 995.
Order from LC mi$2.40, ph$7.80 PB 149 619

The exponential potential function $A e^{-r/\rho}$ is regarded as the true qualitative form of the repulsive intermolecular potential at moderately small internuclear distances (or equivalently, high temperatures). Because of the increasing interest in gases at high temperatures it has become desirable to be able to evaluate the transport properties under these conditions. The calculation of integrals related to the usual collision integrals $\Omega(1,s)$ and cross-sections Q(1) was carried out for the exponential repulsive potential. Some high temperature viscosities were calculated and compared to the calculated results of Amdur and Mason (The Physics of Fluids 1:370-383, Sept.-Oct. 1958), which are based on an experimental scattering potential. (Author)

Arnold Engineering Development Center [Tullahoma, Tenn.].
PERFORMANCE OF A D-C ARC-EXCITED PLASMA GENERATOR, by W. K. McGregor, J. J. Ehrlich, and M. T. Dooley. Rept. on ARO, Inc. Contract AF 40(600)800S/A 11(60-110). Aug 60, 47p. 4 refs. AEDC-TN-60-112.
Order from LC mi$3.30, ph$7.80 PB 149 976

A direct-current, arc-excited plasma generator, designed and fabricated at the Rocket Test Facility, Arnold Engineering Development Center is described. The voltage vs current relationship at different pressures is examined in the light of previous work on simple enclosed arcs. Also an energy balance is presented from which the enthalpy increase of the gas and the energy conversion efficiency is determined. For this generator the arc voltage ranged from 30 to 100 volts, the current ranged from 60 to 1000 amperes, and the chamber pressure was adjusted between 1.1 and 2.4 atmospheres. Power inputs of from 2 to 60 kw to 0.0025 to 0.01 kg sec of argon produced enthalpy rises of from 50 to 1000 kcal/kgm with efficiencies in the range of 65 to 90 percent. Data are reported for both argon and helium used as the working gas. A study of gas contamination due to electrode erosion is also presented; the percentage by weight of contamination at normal operating conditions is shown to be less than 0.05 percent using tungsten and carbon electrodes and 0.003 percent using tungsten and copper electrodes. (Author)

Ballistic Research Labs., Aberdeen Proving Ground, Md.
NORMALLY REFLECTED SHOCK FRONT PARAMETERS, by R. E. Shear and P. McCane. May 60, 17p. 3 refs. Memo. rept. no. 1273.
Order from LC mi$2.40, ph$3.30 PB 150 104

Calculations are presented of pressure, density and temperature changes across a shock front in air which is normally reflected from a perfectly rigid wall. The medium, air, is treated as a real gas. Comparisons are made with the results of Doering and Burkhardt. (Author)

Enrico Fermi Inst. for Nuclear Studies, U. of Chicago, Ill.
RESEARCH ON THE STUDY OF FLUID BEHAVIOR IN THE PRESENCE OF ROTATION AND MAGNETIC FIELD, by S. Chandrasekhar. Final rept. 1 May 55-30 Nov 59, on Contract N6ori-02056. 30 Nov 59, 80p. 103 refs. AD-237 331.
Order from LC mi$4.50, ph$12.30 PB 148 015

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Studies on thermal instability
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    Apparatus for studying convection under the simultaneous action of a magnetic field and rotation
    Experiments on the instability of a layer of mercury heated from below and subject to the simultaneous action of a magnetic field and rotation II
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Studies on heat-transfer
  Theoretical studies
    Heat transfer by convection
    Heat-transport by convection in presence of an impressed magnetic field

Experimental studies
Theoretical and experimental study of heat transfer by cellular convection in the presence of impressed magnetic fields
An experiment on heat transfer by overstable and ordinary convection

General Electric Co., Cincinnati, Ohio.
THERMODYNAMIC AND ELECTRICAL PROPERTIES OF MERCURY VAPOR AT PRESSURES BELOW ATMOSPHERIC AND HIGH TEMPERATURES, by A. Sherman and F. Martinek. Technical note for 1 Feb 59-28 Feb 60 on High Temperature Heat Transfer to Tubes and Nozzles, Contract AF 49(638)243. 1960, 43p. 16 refs. AFOSR-TN-60-657.
Order from LC mi$3.30, ph$7.80 PB 149 815

The thermodynamic properties of mercury vapor have been calculated for temperatures up to 15,000 ^{o}K and pressures between 1 and 10^{-4} atmospheres. The first ionization is shown to be essentially complete at 15,000 ^{o}K. At the lower pressures the ionization is completed earlier. Corrections have been included to account for the lowering ionization potential and the finite limit of the electronic term series. The largest corrections occur at the higher pressures; the correction at 10^{-4} atmospheres being negligible. For example, the temperature required to give 95% degree of ionization at one atmosphere is corrected by approximately 2%. (Author)

Massachusetts Inst. of Tech., Cambridge.
HEAT TRANSFER TO SUPERCRITICAL FREON-12, by J. V. Del Bene and J. P. Barger. Technical rept. no. 2 on Contract Nonr-1841(14). Oct 59, 87p. 6 refs. AD-230 557.
Order from LC mi$4.80, ph$13.80 PB 149 512

The experimental results support data for heat transfer to supercritical water obtained by N. L. Dickinson and C. P. Welch [Trans Am Soc Mech Engrs 80:746-752, 1958]. Both data show a peaking of the local heat transfer coefficient when plotted against wall temperature. Since the theoretical analyses do not predict this behavior, it appears as though these analyses have not simulated the correct physics of the flow and heat transfer mechanisms. Further, the experimental results show that heat transfer to supercritical fluids is extremely complex. The report outlines a procedure for analyzing new data to obtain a better understanding of the phenomena occurring in supercritical heat transfer. The investigation brings to light the problem of decomposition of Freon-12 at high pressures and temperatures. However, it also shows by carefully planning runs, rematching certain "master" runs, and frequently examining the test-section for cleanliness, that Freon-12 can definitely be used to obtain experimental data. Evidence is also given as regards a variation in the critical point of Freon-12 from one bottle of fluid to another. Finally, the details for constructing a detailed pressure-enthalpy diagram for supercritical Freon-12 are presented. (Author)

North American Aviation, Los Angeles, Calif.
DESIGN, CONSTRUCTION, AND TEST OF AN ABSORPTION-EMISSION PYROMETER. 31 July 47, rev. 11 Sep 47. 30p. 1 ref. Rept. no. AL-248.
Order from LC mi$2.70, ph$4.80 PB 152 013

This report released for sale to the public 11 Oct 60.

Experimental data on the instrument is included. The results of comparison tests between the Absorption-Emission Pyrometer and sodium D-line equipment have been taken as evidence of the correctness of the theory underlying the operation of the former. It has proven satisfactory for measuring the temperature of acetylene flames.

[Space Sciences Lab., General Electric Co., Philadelphia, Pa.]
ON THE APPROXIMATE SOLUTION TO THE PROBLEM OF AERODYNAMIC SURFACE MELTING OF A MATERIAL OF LARGE PRANDTL NUMBER, by George W. Sutton. Rept. on Contract AF 04(645)24. 8 Aug 58, 8p. 2 refs. Aerophysics Operation Research Memo. no. 17.
Order from LC mi$1.80, ph$1.80 PB 150 043

The approximate solution may be used only for order of magnitude estimates, since it underestimates the rate of vaporization, and overestimates the energy absorbtion capacity of the melting material.

Space Sciences Lab., General Electric Co., Philadelphia, Pa.
SOME UNEXPECTED RESULTS OF SHOCK-HEATING XENON, by Per Gloersen. Rept. on Contract AF 04(647)269. 26 Apr 60, 56p. 29 refs. Technical Information Series R60SD364.
Order from LC mi$3.60, ph$9.30 PB 148 654

Results from a detailed experimental study of the structure of pressure-driven, incident shock waves in very pure xenon contained in a thoroughly pumped Pyrex shock tube are presented and discussed. As a result of some optical measurements, the following features of the luminosity delay time were discovered: independence of the pressure in the undisturbed xenon in the range 0.75 to 4.0 mm of Hg, dependence on shock velocity in a way not explainable on the basis of reasonable volume processes alone, and dependence on shock tube diameter.

Stanford U., Calif.
TEMPERATURE STRESSES IN SHELLS CAUSED BY LOCAL HEATING, by W. Flügge and G. E. Strickland, Jr. Rept. on Contract Nonr-225(16). 15 June 59, 88p. 15 refs. Div. of Engineering Mechanics Technical rept. no. 118; AD-228 391.
Order from LC mi$4.80, ph$13.80 PB 147 896

Contents:
The basic equations of a heated shell
Shells of zero Gaussian curvature
Shells of constant Gaussian curvature
A generally applicable iterative solution
Tensor notation used in this work
An approximate equation of heat conduction

Theoretical Chemistry Lab., U. of Wisconsin, Madison.

VISCOSITY OF TWO COMPONENT GASEOUS MIXTURES, by Joseph O. Hirschfelder, Marion H. Taylor, and Taro Kihara. Rept. on Contract DA 11-022-ORD-2526. 8 July 60, 18p. 9 refs. WIS-OOR-29; OOR rept. no. 1898.11-C.
Order from LC mi$2.40, ph$3.30 PB 150 411

The conditions are found where the viscosity of a binary mixture of dilute gases either has a maximum or a minimum with respect to variations in the composition. A maximum in the viscosity is most likely to occur for a mixture of a polar and non-polar gas in which the viscosities of the pure components are nearly equal and their molecular weights are quite different. A minimum should occur for a mixture of two non-polar gases in which both the viscosities and molecular weights of the pure components are nearly equal. There are many experimental examples of maxima in the viscosity but up to the present time no cases have been discovered where the viscosity has a minimum. The maximum value of the viscosity and the mole fraction at which it occurs can be used to determine the energy of interaction between unlike molecules. (Author).

Wave Propagation

Antenna Lab., Ohio State U. Research Foundation, Columbus.

BISTATIC REFLECTION CHARACTERISTICS. Final engineering rept. for 1 May 58-31 Oct 59 on Contract AF 19(604)3501. 1 Nov 59, 14p. 5 refs. Rept. 827-7; AFCRC TR-60-116; AD-234 488.
Order from LC mi$2.40, ph$3.30 PB 149 282

Unclassified research is summarized on work performed on the bistatic radar reflection characteristics of simple shapes. Several analytical methods for approximating the echo area were investigated. An echo-measuring system operating from 8.3 to 12.8 kmc in an anechoic chamber was employed for measurements of bistatic radar cross section. A lens-corrected transmitting horn was designed to permit measurements to be taken at close range while maintaining proper illumination of small scatterers. Measurements at any bistatic angle from 0° to 150° can be made as a continuous function of aspect. A method was developed for accurate measurement of relative echo signal phase by comparison with the phase of a nulling signal used to balance the system. Bistatic echo patterns of simple shape such as spheroids, cones, hemispheres, and combinations of these were measured in the principal scattering planes. All measurements were calibrated by comparison with standard spheres, whose echo areas as a function of bistatic angle can be calculated. A pictorial representation is given of the bistatic cross section of small spheres relative to their geometrical cross section for ka (circumference in wavelengths) from 0.8 to 2.9. (Author)

Center for Radiophysics and Space Research, Cornell U., Ithaca, N. Y.

COMMENTS ON THE PROBLEM OF INCOHERENT SCATTERING, by T. Laaspere. Scientific rept. no. 1 on Contract AF 19(604)6158. 15 Dec 59, 56p. 9 refs. Research rept. RS1; AFCRC-TN-60-124; AD-234 842.
Order from LC mi$3.60, ph$9.30 PB 147 883

Contents:
Scattering due to Doppler shift
Scattering due to irregularities in electron density
Effects of the magnetic field on the spectrum of backscatter
  General considerations
  The problem of sidebands
  Second-order effects
Scattering by moving free electrons
  Derivation of the expression for the electric field
Proof that under certain assumptions equal backscattered power is predicted by both approaches
Problems needing clarification
Spectrum of backscatter under the assumption of incoherent scattering by individual electrons
Comments on the problem of addition of powers in radar backscatter
Scattering from a moving string of dipoles
Density fluctuations in an ideal gas
Born's remarks about scattering
A Debye length in three-dimensional problems in mks units.

Centro di Studio per la Fisica Delle Microonde (Italy).

VOLUME DENSITY OF RADIO ECHOES FROM METEOR TRAILS, by N. Carrara, P. F. Checcacci and others. Technical note no. 3 on Contract AF 61(052)227. Oct 59, 24p. 12 refs. AFCRC-TN-60-150; AD-234 545.
Order from LC mi$2.70, ph$4.80 PB 147 886

The volume density of radio echoes from meteor trails has been evaluated by taking into account not only the orientation of the trails, but also the meteor evaporation process and the characteristics of the transmitter-receiver system.

Columbia U. School of Engineering, New York.

RADIO STAR SCINTILLATION AND MULTIPLE SCATTERING IN THE IONOSPHERE, by Dmitri S. Bugnolo. Technical rept. T-5/D on Contract AF 49(638)350. 1 Apr 60, 42p. 10 refs. CU-12-60-AF-350-EE; AFOSR-TN-60-451; AD-237 587.
Order from LC mi$3.30, ph$7.80 PB 148 067

Recent experimental evidence of radio star scintillation indicates that multiple scattering effects are of importance in the ionosphere. It is therefore of interest to apply the transport equation for the expectation of the photon density function to this problem. The solution of the transport equation is used to predict the mean squared scattering angle and corresponding size of the ionospheric irregularities as measured on the earth. The particular example discussed in detail is based on a Gallet model for turbulence in the underside of the F layer under night time conditions. However, it should be noted that the general theoretical results can be applied to any other model as well. (Author)

Columbia U. School of Engineering, New York.
SURFACE WAVES ON RADIALLY INHOMOGENEOUS DIELECTRIC CYLINDERS: FORMULATION OF PROBLEM, by Arvids Vigants. Technical rept. no. 2 on Contract AF 19(604)3879. 1 June 60, 31p. 18 refs. CU-10-60-AF-3879-EE; AFCRC-TN-60-584.
Order from LC mi$3.00, ph$6.30 PB 149 807

Differential equations for Hertz potentials describing surface wave propagation in a medium with circular cylindrical symmetry and radial variation of permittivity have been derived. The equations are in the form of a system of two linear second order differential equations with variable coefficients. Series solutions of the differential equations, valid close to cutoff, have been formulated. (Author)

Cornell U. School of Electrical Engineering, Ithaca, N. Y.
REFLECTION OF RADIO WAVES FROM THE SUN. by Takeo Hatanaka. Technical rept. no. 2 on Contract Nonr-401(27). 15 Oct 59, 14p. 6 refs. Research rept. EE-450; AD-230 795.
Order from LC mi$2.40, ph$3.30 PB 149 873

The possibility of receiving a radio echo from the sun, especially at a frequency of 400 Mc/s, is discussed. Attenuation in the solar atomosphere, assuming a smooth atmosphere, is found to be so large that no echo is expected from the sun. This is in agreement with previous results where echoes at lower frequencies were predicted. Reflections from prominences and coronal condensations, and incoherent scattering from electrons are also considered, with almost negative results. (Author)

Electrical Engineering Research Lab., U. of Illinois, Urbana.
USE OF THE SMITH CHART AND OTHER GRAPHICAL CONSTRUCTIONS IN THE MAGNETO-IONIC THEORY, by G. A. Deschamps and W. L. Weeks. Scientific rept. no. 1 on Contract AF 19(606)5565. 20 Apr 60, 61p. 7 refs. AFCRC-TN-60-468.
Order from LC mi$3.90, ph$10.80 PB 150 095

The complex refractive index of a magnetoionic medium for various directions of propagation is evaluated graphically. Most of the constructions make use of a Smith Chart on which the scales have been suitably relabled. The directions considered are longitudinal, quasi-longitudinal, transverse, and quasi-transverse with respect to the applied magnetic field. The losses are taken into account. The energy transferred to the medium is characterized by conductivity coefficients that are also evaluated graphically. By using an overlay the refractive index is converted into the reflection coefficient at a plane boundary of the medium. (Author)

Electrical Engineering Research Lab., U. of Texas, Austin.
SOME EFFECTS OF TREES ON LOW ANGLE RADIO PROPAGATION AT A WAVELENGTH OF 10.4 CM, by A. H. LaGrone and C. W. Chapman. Rept. on Contract AF 19(604)5504. 15 July 60, 32p. 4 refs. Rept. no. 6-36; ERD-TN-60-766.
Order from LC mi$3.00, ph$6.30 PB 149 977

Results are reported of measurements made at very low angles of 2,880 mcps signals over wooded areas with the elevation angle to the transmitter the principal variable. A narrow beam receiving antenna was used to observe the effect of the trees on the apparent location of the signal source. Various measurements were made on the effects of a single large tree on the signal. A hypothetical direction finding system was assumed and its pointing characteristics determined. Theoretical curves were computed and were presented to assist in the evaluation of sights selected for low angle direction finding systems. (Author)

Institute of Mathematical Sciences, New York U., N. Y.
REMARKS CONCERNING THE DETERMINATION OF ELECTRON DISTRIBUTION IN THE IONOSPHERE BY MEANS OF RADIO SOUNDINGS, by Irvin Kay. Rept. on Contract AF 19(604)3495. Nov 59, 11p. 9 refs. Research rept. no. EM-149; AFCRC-TN-59-978; AD-233 306.
Order from LC mi$2.40, ph$3.30 PB 148 987

Institute of Mathematical Sciences, New York U., N. Y.
THE VIRTUAL MASS OF A FINITE CONICAL SHELL, by Ellis J. Rich and Samuel N. Karp. Rept. on Contract AF 19(604)5238. May 60, 17p. 5 refs. Research rept. no. EM-158; AFCRC-TN-60-393.
Order from LC mi$2.40, ph$3.30 PB 150 055

The purpose of this paper is to obtain a solution of a hitherto unsolved problem in fluid flow, particularly, in the way a finite conical shell affects the flow of fluid in which the direction of travel at infinity is parallel to the axis of the cone. The solution has applications not only in fluid dynamics but also in the calculation of the scattering of an electromagnetic wave by such a cone at low frequency, the latter being of current technological interest. The principal results obtained are a formula for the dipole coefficient at infinity, and for a related quantity, the virtual mass, in terms of the cone angle. A subsidiary result is the expression of the velocity potential at all points of space. (Author)

Navy Electronics Lab., San Diego, Calif.
ATMOSPHERIC REFRACTION ERROR IN RADAR ELEVATION ANGLES, by W. F. Moler and E. E. Gossard. Rept. for 1 July 56-1 May 57. 12 July 57, 24p. 4 refs. Research rept. no. 795; AD-205 222.
Order from LC mi$2.70, ph$4.80 PB 147 572

The theory of radar range and angular tracking errors for high elevation angles is reviewed. Several modifications of the theory, for use in practical applications, are introduced. It is shown that the surface refractive index can be used to predict angular error for targets above 10^5 feet for ground-sited radars. Radiosonde data from five arctic stations were analyzed in terms of frequency distribution of angular error by seasons. Radiosonde data previously analyzed by the Air Defense Command Forecast Center were used to obtain approximate frequency distributions of angular error for stations along the northern border of the United States. Surface weather observations taken hourly from three arctic stations were

analyzed to determine the period and magnitude of angular error changes for periods shorter than those which could be analyzed from the radiosonde data. (Author)

National Bureau of Standards, Boulder, Colo.
LOW- AND VERY LOW-RADIOFREQUENCY MODEL IONOSPHERE REFLECTION COEFFICIENTS, by J. R. Johler, L. C. Walters, and J. D. Harper, Jr. 1 July 60, 139p. Technical note no. 69.
Order from OTS $2.00 PB 161 570

The results of extensive computations performed during the course of a theoretical investigation of a sharply bounded model ionosphere for low- and very low-radiofrequency wave propagation are presented in the form of graphs and tables. (Author)

National Bureau of Standards, Boulder, Colo.
RADIO REFRACTOMETRY, by Jack W. Herbstreit. June 60, 20p. 44 refs. Technical note no. 66.
Order from OTS $0.50 PB 161 567

The measurement of the radio refractive index properties of the atmosphere and the application to radio propagation problems is the subject of this paper.

Navy Electronics Lab., San Diego, Calif.
AN ANNOTATED BIBLIOGRAPHY OF LITERATURE PERTINENT TO TROPOSPHERIC SCATTER PROPAGATION, 1945-1957, by N. R. Ortwein. Rept. for Dec 57-June 58. 4 Aug 58, 28p. 113 refs. Research rept. 858; AD-216 127.
Order from LC mi$2.70, ph$4.80 PB 147 571

Norwegian Defence Research Establishment.
SOME PROPERTIES OF THE REGULAR AND IRREGULAR IONOSPHERIC LAYERS NEAR THE AURORAL ZONE, by Bernt Maehlum. Rept. on Contract AF 61(514)937. Mar 59, 59p. 7 refs. NDRE rept. no. 29; AFCRC-TN-60-152; AD-234 543.
Order from LC mi$3.60, ph$9.30 PB 147 881

Some studies of the ionospheric layers are reported as observed near the auroral zone. The study is mainly based on the routine, hourly h'f-recordings from the Norwegian stations. The statistical behavior of the layers E, F1 and F2 is also treated. Studies of the irregular layers Es and Fs are presented. A short study of the occurrence of polar blackouts is given. (Author)

Physical Research Lab., Space Tech. Labs., Inc., Los Angeles, Calif.
A MAGNETICALLY INSULATED SHOCK TUBE, by Richard G. Fowler and Eugene B. Turner. Rept. on Contract AF 04(647)309. [1959] 48p. 7 refs. STL/TR-60-0000-09180.
Order from LC mi$3.30, ph$7.80 PB 149 762

This report describes experimental results obtained with a magnetically insulated shock tube. The one-inch diameter tube is enclosed by a solenoid field coil which produces a longitudinal magnetic field of up to 20,000 Gauss throughout both the electrical discharge and expansion chambers. Peak currents of up to 95,000 amperes are produced in the discharge tube by a 50 μf capacitor bank charged up to about 8 kv. The electrical characteristics of the discharge were determined from voltage and current signals. The magnetic field was found to substantially reduce the attenuation of the shock wave moving down the tube, presumably by a reduction of the boundary layer thickness behind the shock wave. With a magnetic field strength of 7500 Gauss and higher, a contact surface, such as occurs in diaphragm type shock tubes, is clearly defined in the wave speed pictures, while at zero and low magnetic field strengths the contact surface is not visible. There was evidence from the reflected shock velocities and from the convex shape of the shock front that the magnetic field was inhibiting the degrees of freedom perpendicular to the field lines resulting in a gas with a higher effective γ. (Author)

Stanford Electronics Labs., Stanford U., Calif.
A RAPID BEAM-SWINGING EXPERIMENT IN TRANS-HORIZON PROPAGATION, by A. T. Waterman, Jr. Rept. on Contract DA 36-039-sc-73151. 23 July 58, 10p. 9 refs. Technical rept. no. 770-1; AD-203 173.
Order from LC mi$1.80, ph$1.80 PB 149 404

By using a broadside phased array for an antenna, a narrow beam can be swung, rapidly and in quick succession through a limited sector by fast control of the phasing, rather than by movement of the entire antenna structure. This technique is used at the receiving end of a 101-mile beyond-the-horizon transmission path in order to probe the portion of the troposphere through which the signal is propagated. At the frequency employed of 3.12kMc, a 0.49° beam is swung in azimuth through a 4.2° sector each tenth of a second. A variety of phenomena are observed with this technique which have not been directly apparent in slower beam-swinging experiments.

Stanford Electronics Labs., Stanford U., Calif.
SOME PROPERTIES OF RADIO WAVES REFLECTED FROM THE MOON AND THEIR RELATION TO THE LUNAR SURFACE, by Tor Hagfors. Scientific rept. no. 8 on Contract AF 19(604)2193. 8 Aug 60, 30p. 12 refs.
Order from LC mi$2.70, ph$4.80 PB 150 239

This report presents a theoretical discussion of the statistical properties of radio waves reflected from the moon. This discussion is based on the assumption of a large number of scattering areas simultaneously contributing to the signal. The properties of the echoes are usually described in terms of pulse broadening or by means of an average-power pulse-response when very short pulses are transmitted. Here it is shown that the same type of information may be obtained by studying the correlation of complex amplitudes of two sine waves reflected from the moon at frequencies separated by $\Delta\omega$. By studying this correlation as a function of $\Delta\omega$ it is possible to compute the power pulse response of the earth-moon-earth propagation circuit. It is suggusted that this method will prove particularly useful in the study of the surface properties of distant targets such as the planets of our solar system. It is also shown how the correlation technique can be extended to a two-dimensional mapping of a rotating rough body. (Author).

Stanford Electronics Labs., Stanford U., Calif.
THE USE OF NOSE WHISTLERS IN THE STUDY OF THE OUTER IONOSPHERE, by R. L. Smith, Technical rept. no. 6 on Contract AF 18(603)126. 11 July 60, 127p. 85 refs. AFOSR-TN-60-861.
Order from LC mi$6.30, ph$19.80 PB 149 752

Electromagnetic energy at very low frequencies can be propagated from one hemisphere to the other along the earth's magnetic field lines in the outer ionosphere. The action of free electrons disperses the original impulse-like signal (from a lightning discharge) to form descending gliding tones, called whistlers. If the highest frequency of the whistler is comparable with the minimum electron gyrofrequency along the propagation path, the dispersion at the higher frequencies causes rising tones which are contiguous with the descending tones at the lower frequencies. The whistler is then called a "nose" whistler. Spectrographic analysis of whistlers and nose whistlers often reveals a number of pure isolated components which have a common source. Examination of whistler data and a new theory of the propagation path lead to the conclusion that each component represents energy from the lightning source which has been trapped in a field-aligned column of enhanced ionization in the outer ionosphere. The data indicate that the lifetime of these columns is a few hours. The theory suggests that enhancements of approximately five per cent are sufficient to explain the observed whistlers. The theory further indicates that the average group velocity of energy trapped in a column can be closely approximated by assuming that the energy travels along the maximum of ionization in the column with wave normals aligned with the magnetic field. The frequency of minimum time delay, called the nose frequency, indicates the location of the field line path. The minimum time delay gives a measure of the ionization density in the region near the top of the path. Examination of nose whistler data from a number of stations leads to a model of electron density in the outer ionosphere. The data also show an annual variation of 2:1 in the ionization density during sunspot maximum. (Author).

RESEARCH METHODS, TECHNIQUES AND EQUIPMENT

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
MARK I PERCEPTRON OPERATORS' MANUAL, by John C. Hay, Ben E. Lynch and others. Rept. on Proj. PARA, Contract Nonr-2381(00). 15 Feb 60, 62p. 6 refs. Rept. no. VG-1196-G-5; AD-236 965.
Order from OTS $1.75 PB 161 997

This report released for sale to the public 16 Sep 60 (USGRR, v. 34, p. 350)

The Mark I Perceptron is a pattern learning and recognition device. It is intended as an experimental tool for the direct study of a limited class of perceptrons. This manual is intended primarily as a guide to the setting up and operation of the machine. It does not require extensive familiarity with the theory of perceptron systems. For those familiar with the theory, but not necessarily concerned with actually operating the machine, the manual should serve to indicate the machine's potentialities as a research instrument.

Cornell Aeronautical Lab., Inc., Buffalo, N. Y.
ON THE CONVERGENCE OF REINFORCEMENT PROCEDURES IN SIMPLE PERCEPTRONS, by Frank Rosenblatt. Rept. on Project PARA, Contract Nonr-2381(00). 15 Feb 60, 72p. 9 refs. Rept. no. VG-1196-G-4 and amendments 1, 2; AD-234 874.
Order from OTS $2.00 PB 161 996

This report released for sale to the public 16 Sep 60, (USGRR, v. 34, p. 350)

Previous reports have described a number of theoretical nerve nets called perceptrons, and have attempted to analyze their ability to associate responses to stimuli using a variety of training procedures and memory functions. Proofs have been found for a number of theorems of fundamental importance for the theory of such networks. The main findings are summarized: (1) there exist certain simple memory functions and training procedures by which it can be guaranteed that a perceptron will ultimately arrive at a solution to any given response-association problem; (2) a variety of problems are shown to be soluble; (3) the same procedures which yield solutions for binary classification problems can be employed to assign arbitrary response functions to stimuli; and (4) a considerable variety of perceptron models, differing from one another in the transfer functions of their association units, are shown to be identical with respect to their ability to arrive at solutions to learning problems. Included are amendment 1 (Technical memo. no. 12, AD-236 736), and amendment 2, Improved Error Correction Procedure, (Technical memo. no. 13).

Institute for the Study of Metals, U. of Chicago, Ill.
HIGH PRESSURE RESEARCH, SERIES II. Annual rept. no. 3, Series 2, Oct 58-Oct 59, on Contract Nonr-2121(03). [1959] 87p. 103 refs.
Order from LC mi$4.80, ph$13.80 PB 149 485

Contents:
On the dynamical theory of diffusion in crystals. III. Some model calculations and relation to continuum theory
Preliminary experiment on the quenching of lattice defects in noble metals under hydrostatic pressure up to 8500 bars
Diffusion measurements under pressure in the temperature range 800-1000°C
Internal friction in iron at low temperatures
The formation of an amorphous form of quartz under shock conditions
A note on the behavior of iron under static high pressures
Diffusion of cadmium in pure and cadmium doped AgBr
The relation between the Eyring and Doolittle diffusion equations
The effect of pressure on self-diffusion in lead
A new device for obtaining X-ray diffraction patterns from substances exposed to high pressure
A high-pressure microwave window
Diffusion of impurities in amorphous polymers
(See also PB 143 063)

Institute of Mathematical Sciences, New York U., N. Y.
TOPICS IN THE THEORY OF DISCRETE INFORMATION CHANNELS, by Richard A. Silverman and Sze-Hou Chang. Rept. on Contracts AF 19(604)5238 and AF 19(604)3053. Apr 60, 45p. 17 refs. Research rept. no. EM-152; AFCRC-TN-60-366.
Order from LC mi$3.30, ph$7.80 PB 150 034

The present article discusses various topics in the theory of discrete information channels, including the general binary channel, channels with fading, cascaded channels, and channels with memory. (Author)

Statistical Techniques Research Group, Princeton U., N. J.
AUTOCORRELATION ANALYSIS AND THE DESIGN OF EXPERIMENTS, by G. M. Jenkins and J. Chanmugam. Technical rept. no. 37 on Contract DA 36-034-ORD-2297. June 60, 76p. 26 refs. OOR rept. no. 1715:34; AD-239 911.
Order from LC mi$4.50, ph$12.30 PB 150 403

These are many examples in industry and in the sciences of situations where the uncontrolled variation in the observed responses is subject to autocorrelation when the independent variables are kept constant. The present work is concerned with the investigation into the effect of this autocorrelation on the strategy of experimentation.

Communication Theory

Applied Mathematics and Statistics Labs., Stanford U., Calif.
SPECTRAL ANALYSIS OF A PROCESS OF RANDOMLY DELAYED PULSES, by M. V. Johns, Jr. Technical rept. no. 51 on Contract N6onr-25140. 10 Oct 59, 15p. 5 refs.
Order from LC mi$2.40, ph$3.30 PB 149 944

The purpose of this report is to obtain formulae for the covariance and asymptotic spectral distribution functions of a process consisting of a sequence of pulses separated by random time delays.

Ohio State U. Research Foundation, Columbus.
ORTHOGRAPHIC REPRESENTATIONS OF ENGLISH PRONUNCIATION AS AN AID IN TEACHING ILA, by Henry M. Moser, Herbert J. Oyer, and Wallace C. Fotheringham. Technical rept. no. 56 on Contract AF 19(604)4575. Dec 59, 110p. AFCRC-TN-59-75.
Order from LC mi$5.70, ph$16.80 PB 150 248

Specially devised orthographies in Chinese, Dutch, French, German, Italian, Japanese, Korean, Spanish, and Thai were constructed for a list of common English aviation words as an aid to their pronunciation by foreign nationals. Those prepared for German, Japanese, and Spanish were employed with native speakers of these three languages at the AF Language School, Lackland AFB, Texas. It was found that for each of these three groups, the specially designed orthographies, with or without the additional aid of auditory stimulation, resulted in significantly more intelligible pronunciations than the reading of these aviation words from only a printed list. Additionally, each individual speaker in this study improved the intelligibility of his pronunciations when aided by the appropriate orthography. The comparative value of orthography alone vs. orthography plus auditory stimulation varies considerably among language groups. The average improvement would make a distinguishable difference in the air traffic communication setting. (Author)

Photographic Equipment

Ballistic Research Labs., Aberdeen Proving Ground, Md.
BALLISTIC CAMERA (BC-4) SYNCHRONIZATION SYSTEM, by Ralph E. A. Putnam. May 60, 37p. 2 refs. Rept. no. 1108; AD-240 010.
Order from LC mi$3.00, ph$6.30 PB 149 765

Prospects for utilizing ballistic cameras in precision tracking of missiles and satellites, as well as in geodetic work, have been enhanced by the development of a high precision camera (Wild BC-4) with optical properties suitable for these applications. While these cameras have proved useful in night-time tracking of targets carrying short duration flashing lamps, full utilization of their potential capabilities has been restricted by lack of means to synchronize exposures of widely spaced cameras to the high degree of accuracy necessary. This report describes a synchronization system developed for these cameras, and presents test data on a laboratory setup of the essential system elements.

Johns Hopkins U., Baltimore, Md.
INCREASED FIELD DEPTH IN TRACK PHOTOGRAPHY BY MEANS OF SPHERICAL ABERRATION, by F. Rasetti. Rept. on Contract AF 18(603)143. May 60, 5p. AFOSR-TN-60-531.
Order from LC mi$1.80, ph$1.80 PB 149 359

A considerable increase in depth of field for a given luminosity of the lens can be obtained by using a lens provided with convenient spherical aberration instead of a perfectly corrected lens.

SOCIAL SCIENCES

Documentation

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
TEST PROGRAM FOR EVALUATING PROCEDURES FOR THE EXPLOITATION OF LITERATURE OF INTEREST TO METALLURGIST. II. ACQUISITION OF DOCUMENTS FOR MACHINE SEARCHING, by Allen Kent, Alan M. Rees and Jessica Melton. Rept. on National Science Foundation Grant NSF-G-10338. [1960] 47p.
Order from LC mi$3.30, ph$7.80 PB 149 845

In order to permit a significant test, it was necessary first to expand substantially the subject coverage of the service to provide literature of interest to metallurgists. The activity involved in this preparatory program include identification and acquisition of documents of potential interest.

Center for Documentation and Communication Research, Western Reserve U., Cleveland, Ohio.
TEST PROGRAM FOR EVALUATING PROCEDURES FOR THE EXPLOITATION OF LITERATURE OF INTEREST TO METALLURGISTS, III, ANALYSIS AND QUALITY CONTROL, by Allen Kent, Jessica Melton, and Alan M. Rees. Rept. on National Science Foundation Grant NSF-G-10338. [1960] 54p 4 refs.
Order from LC mi$3.60, ph$9.30 PB 150 260

In two earlier reports, there were described the background and plans and the acquisitions program of the ASM mechanized searching service which is to be evaluated. The present report covers the procedures for analysis and quality control of abstracts of documents included in this service, and discusses the alterations in procedures that have been necessitated by the expansion of the service to fields allied to, but outside of the core of metallurgy. (Author).

Michelson Labs., Naval Ordnance Test Station, China Lake, Calif.
WRITING THE TECHNICAL ARTICLE: A MATTER OF DESIGN, by Gerard A. Pottebaum. July 60, 12p. 6 refs. Technical Article 6; NOTS TP-2432.
Order from LC mi$2.40, ph$3.30 PB 150 169

This article discusses some fundamental practices that apply in both fiction and exposition. The design of the formal report is briefly reviewed, the design of the article is analyzed, and the two are compared. (Author)

Office of Scientific Research and Development.
MICROFILM INDEX. 1946, declassified 24 Aug 60. 770p. 18000 refs.
Order from OTS $8.00 ($10.00 foreign) PB 161 976

This volume is an index of the technical laboratory and field reports and other reference material which appeared in the bibliographies for the Summary Technical Reports of NDRC. It is divided into three separate sections: (1) a microfilm index and bibliographical listing of reports for each division, panel, and committee; (2) a cross reference composed of microfilm index headings and items culled from information contained in the report titles; and (3) a microfilm reel catalogue.

Zator Co., Cambridge, Mass.
SOME MATHEMATICAL FUNDAMENTALS OF THE USE OF SYMBOLS IN INFORMATION RETRIEVAL, by Calvin N. Mooers. Rept. on Contract AF 30(602)1900 Apr 59, 22p. 10 refs. ZTB-123; RADC-TN-59-133; AD-213 782.
Order from LC mi$2.70, ph$4.80 PB 147 541

A mathematical model and formalism is presented for the process of gaining information through observation, reporting the information, and retrieving it. The model makes use of observational operators H acting upon a hypothetical space of events $\{e\}$. A digital representation of the events and operators is introduced and a formalism of their interaction is developed. The action of the operators H on $\{e\}$ is shown to produce open sets. In terms of the open sets, the possibility of achieving smoothness or continuity in the transformation from the imagined event p prescribing retrieval to the retrieved information is developed. A number of theorems result.

MISCELLANEOUS

Naval Research Lab., Washington, D. C.
REPORT OF NRL PROGRESS. Nov 60.
Order from OTS $1.25, $10.00/year PB 161 287

Contents:
Articles:
Multichannel, Multicolor Oscilloscope, by S. H. Hersh
Summary of Rocket Astronomy and Astrophysics Research at NRL (March 1959-October 1960), Staff Written
Scientific program:
Atmosphere and Astrophysics: Measurement of water vapor distribution in the stratosphere
Chemistry: Radiant transfer of heat and the thermal conductivity of "flinak". Anodic oxidation of the Ag-Ag_2O electrode in alkaline solutions. Isothermal study of the concentration and transport of radioactive steel components in liquid lithium. Removal of organic contaminants from the atmosphere of a submarine by a sodium zeolite (Type 13X molecular sieve)
Mechanics: Effect of chamfered bolt holes on bolts in shear under dynamic load. Dynamics of the lower yield strength of mild steel. Thermoelectric power of indium-lead alloys
Metallurgy and Ceramics: Validity of a cyclic heating-cooling method of measuring the electronic specific heat of nickel-palladium alloys. New method for analyzing small, metallic, irradiated specimens. Thermodynamic analysis of solubility in liquid metal systems
Optics: Photometry at low levels of intensity. A closed-circuit TV system for passive use at night
Radio: Ocean wave-profiling radar system. Electrical breakdown in high vacuum (electron tubes)
Solid-State Physics: Variation of effective mass ratio with magnetic field for InAs at room temperature. Model for describing the effect of pressure on the absorption and emission spectra of alkali halide phosphors
Sound: Digital amplitude probability distribution analyzer. Effect of hydrostatic pressure on ten groups of electrical and electronic components to be used in oceanographic experiments

ATOMIC ENERGY COMMISSION REPORTS

Reports may be purchased in accordance with instructions on the inside front cover of the U. S. GOVERNMENT RESEARCH REPORTS. As PB numbers are not indicated, order by series and number. These reports may also be consulted at any AEC Depository Library. A list of these libraries may be obtained from the U. S. Department of Commerce, Office of Technical Services, Washington 25, D. C.

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General

Report number series. Used by the Office of Technical Information in Cataloging Reports. Report number system, by F. E. Stratton. Office of Technical Information Extension, Oak Ridge, Tenn. Aug 60. 23p. Order from OTS. 50 cents. TID-85 (2nd Rev., Suppl.)

Biology and Medicine

Description of facilities and mechanical components medical research reactor (MRR), by J. B. Godel. Brookhaven National Laboratory, Upton, New York. Feb 60. 64p. Order from OTS. $1.75. BNL-600 (T-173)

Biological effects of Sr^{90} in miniature swine. I. Experimental designs and preliminary observations, by W. J. Clarke and J. R. McKenney.. Hanford Atomic Products Operation, Richland, Wash. Jan 60. Contract AT(45-1)-1350. 10p. Order from OTS. 50 cents. HW-63499

Literature search on the relative biological effectiveness (RBE) of ionizing radiations, by W. H. Langham, and others. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Mar 60. Contract W-7405-ENG-36. 251p. Order from OTS. $3.50. LAMS-2343

Biology and Medicine semiannual report for October 1959 through March 1960, by J. H. Lawrence and A. Pfau. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. 210p. Order from OTS. $3.00. UCRL-9235

Relation of adrenal cortical volume to survival following x-irradiation, by A. P. Casarett and F. T. Brayer. The University of Rochester, Rochester, N. Y. June 60. Contract W-7401-eng-49. 31p. Order from OTS. 75 cents. UR-574

Chemistry—General

Analysis of yttrium metal and yttrium oxide (No. 3 of a Series), by J. O. Hibbits and others. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati 15, Ohio. July 60. Contracts AT(11-1)-171 and AF 33(600)-38062. 15p. Order from OTS. 50 cents. APEX-571

Measuring the release of short-lived fission gases during capsule irradiations, by C. W. Townley and other. Battelle Memorial Institute, Columbus, Ohio. Sep 60. Contract W-7405-eng-92. 9p. Order from OTS. 50 cents. BMI-1466

X-ray spectrographic determination of potassium, uranium, and thorium in pyrochemical samples, by M. C. Lambert. Hanford Atomic Products Operation, Richland, Wash. June 60. Contract AT(45-1)-1350. 23p. Order from OTS. 75 cents. HW-65801

A high-temperature vacuum extensometer, by J. R. Bohn and G. Murphy. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. July 60. Contract W-7405-eng-82. 24p. Order from OTS. 50 cents. IS-167

Performance characteristics of an electromagnetic pump, by D. H. Thompson and R. W. Fisher. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. Aug 60. Contract W-7405-eng-82. 49p. Order from OTS. $1.25. IS-188

The heats of fusion of the cadmium halides, mercuric chloride, and bismuth bromide, by L. E. Topol and L. D. Ransom. Atomics International A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 60. Contract AT(11-1)-GEN-8. 7p. Order from OTS. 50 cents. NAA-SR-5111

A vibrational potential function for symmetrically substituted biphenyls, by R. H. Shudde and G. W. Lehman. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Aug 60. Contract AT(11-1)-GEN-8. 19p. Order from OTS. 50 cents. NAA-SR-5153

Thermal decomposition of uranyl sulfate, by K. J. Notz, Jr. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Mar 60. Con-AT(30-1)-1156. 48p. Order form OTS. $1.25. NLCO-814

Dichlorobenzidine as a curing agent for adiprene L-100, by A. J. Quant. Sandia Corporation, Albuquerque, N. Mex. Sep 60. 14p. Order from OTS. 50 cents. SCR-187

Master Analytical Manual. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 60. 612p. Order from OTS. $6.75. TID-7015 (Suppl. 2)

Micro determination of carbon in metals, by J. W. Frazer and R. T. Holzmann. University of California, Lawrence Radiation Laboratory, Livermore, Calif. June 60. Contract W-7405-eng- 48. 7p. Order from OTS. 50 cents. UCRL-6020

Analysis of current distribution in electrolytic cells with flowing mercury cathodes, Thesis, by E. A. Grens II. University of California, Lawrence Radiation Laboratory, Berkeley, Calif. July 60. Contract W-7405-eng-48. 78p. Order from OTS. $2.00. UCRL-9187

Fractional crystallization from melts, by W. R. Wilcox. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 239p. Order from OTS. $3.00. UCRL-9213

The electronic structure of octahedrally coordinated protactinium (IV). Thesis, by J. D. Axe. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. July 60. Contract W-7405-eng-48. 68p. Order from OTS. $1.75. UCRL-9293

The effect of angular momentum on fission probability. Thesis, by J. Gilmore. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. July 60. Contract W-7405-eng-48. 84p. Order from OTS. $2.00. UCRL-9304

The performance of base-form ion exchangers for pH control and removal of radioisotopes from a pressurized water reactor system, by G. P. simon, C. S. Abrams, and W. T. Lindsay, Jr. Westinghouse Electric Corporation, Bettis Atomic Power Laboratory, Pittsburgh, Pa. July 60. Contract AT-11-1-GEN-14. 69p. Order from OTS. $1.50. WAPD-TM-215

Air lift pumps - characteristics and application to liquid-liquid extraction systems, by J. S. Hurst. Union Carbide Nuclear Company, Division of Union Carbide Corporation, Y-12 Plant, Oak Ridge, Tenn. May 60. Contract W-7405-eng-26. 23p. Order from OTS. 50 cents. Y-1304

Chemistry—Radiation and Radiochemistry

Photoproduction of calcium-47, by M. S. Foster, D. L. Weaver and A. F. Voigt. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. Aug 60. Contract W-7405-eng-82. 16p. Order from OTS. 50 cents. IS-184

Chemistry—Separation Processes for Plutonium and Uranium

The fluorination of uranium from dried solids and its application to the fluoride volatility process, by C. E. Johnson and J. Fischer. Argonne National Laboratory, Argonne, Ill. Aug 60. Contract W-31-109-eng-38. 19p. Order from OTS. 50 cents. ANL-6117

Reprocessing of power reactor fuels. Ninth quarterly progress report for October 1, 1959 to January 1, 1960, by L. H. Meyer and others. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. C. Mar 60. Contract AT(07-2)-1. 11p. Order from OTS. 50 cents. DP-479

Study of the feasibility of aqueous recovery of spent fuels. Part 4. Equipment design data, by R. J. Annesser and others. University of Michigan, Engineering Research Institute, Ann Arbor, Mich. July 54. Decl. August 22, 1960. 295p. Order from OTS. $1.60. ERI-2240-4-F

Study of the feasibility of aqueous recovery of spent fuels. Part 7. Analysis of costs and engineering evaluation of results of study, by J. G. Lewis and H. A. Ohlgren. University of Michigan, Engineering Research Institute, Ann Arbor, Mich. July 54. Decl. August 24, 1960. 144p. Order from OTS. 80 cents. ERI-2240-7-F

Nitric acid dissolution of uranium-aluminum alloy, by R. E. Burns and C. H. Holm. Hanford Works, Nucleonics Division, Richland, Wash. Aug 52. Decl. August 12, 1960 Contract W-31-109-Eng-52. 19p. Order from OTS. 30 cents. HW-18414

Darex pilot plant studies, by J. J. Shefcik. Hanford Atomic Products Operation, Richland, Wash. Feb 60. Contract AT(45-1)-1350. 34p. Order from OTS. $1.00. HW-64010

Yankee band cutting, by V. L. Hammond and V. P. Kelly. Hanford Atomic Products Operation, Richland, Washington. June 60. Contract AT (45-1)-1350. 20p. Order from OTS. 50 cents. HW-65380

Idaho Chemical Processing Plant technical progress report for January through March 1960, by C.M. Slansky and others. Phillips Petroleum Company, Idaho Falls, Idaho. July 60. Contract AT(10-1)-205. 61p. Order from OTS. $1.50. IDO-14520

Processing of high-fired uranium dioxide fuels by a reduction--mercury extraction--oxidation process, by A. F. Messing and O. C. Dean. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-25. 13p. Order from OTS. 50 cents. ORNL-2909

Recovery of uranium from DI (2-ethylhexyl) phosphoric acid (Dapex) extractant with ammonium carbonate, by F. J. Hurst and D. J. Crouse. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 19p. Order from OTS. 50 cents. ORNL-2952

Controlled Thermonuclear Processes

Crowbar code, by D. A. Baker and L. W. Mann. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. May 60. Contract W-7405-ENG-36. 32p. Order from OTS. 75 cents. LAMS-2435

Quarterly report covering the period January 1 through March 31, 1960, by K. Bernstein and others. Project Matterhorn, Princeton University. Princeton, N. J. Sep 60. Contract AT(30-1)-1238. 32p. Order from OTS. 75 cents. MATT-Q-10

Diagnostic methods for space potentials in ion beams, by T. O. Passell. University of California, Lawrence Radiation Laboratory, Livermore, Calif. Feb 60. Contract W-7405-eng-48. 44p. Order from OTS. $1.25. UCRL-5819-T

Electron beam pinch. Thesis by E. R. Horton and R. L. Spoerlein. University of California, Lawrence Radiation Laboratory, Livermore, Calif. June 60. Contract W-7405-eng-48. 27p. Order from OTS. $1.00. UCRL-6011

Instability of a positive column in a magnetic field, by T. K. Allen, G. A. Paulikas, and R. V. Pyle. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. May 60. Contract W-7405-eng-48. 22p. Order from OTS. 50 cents. UCRL-9110

Criticality Studies

Results of critical experiments in loose lattices of UO_2 rods in H_2O, by V. E. Grob and others. Westinghouse Electric Corporation, Atomic Power Department, Pittsburgh, Pa. Mar 60. Contract AT(30-1)-2176. 51p. Order from OTS. $1.50. WCAP-1412

Equipment, Methods and Techniques

Status of Sandia Laboratory hypersonic facilities, by R. C. Maydew. Sandia Corporation, Albuquerque, N. Mex. Aug 60. 15p. Order from OTS. 50 cents. SCR-230

Enclosure and sealing methods, by G. S. Wallace. Sandia Corporation, Albuquerque, N. Mex. July 60. 23p. Order from OTS. 75 cents. SCTM-184-60(25)

Capability improvement study of a tracer-controlled duplicating lathe, by E. B. Del Grande and other others. Union Carbide Nuclear Company, Y-12 Plant, Oak Ridge, Tenn. Apr 60. Contract W-7405-eng-26. 53p. Order from OTS. $1.25. Y-1297

Geology and Mineralogy

Airborne and ground reconnaissance in the Espanola area, Sante Fe County, New Mexico, by G. E. Collins and R. E. Freeland. Production Evaluation Division, , Grand Junction Operations Office, Denver, Colo. Oct 56. 16p. Order from OTS. 50 cents. RME-1075 (Rev.)

Health and Safety

Metal recovery plant radiation report for January to March, 1957, by C. D. Hylton. Oak Ridge National Laboratory, Oak Ridge, Tenn. Oct 57. Decl. July 26, 1960. 6ontract W-7405-eng-26. 6p. Order from OTS. 25 cents. ORNL-2359

A system for automated presentation of a vigilance task and recording of subject performance, by H. E. Anderson. Sandia Corporation, Albuquerque, N. Mex. July 60. 17p. Order from OTS. 75 cents. SCTM-188-60(14)

Inspection of a fire-damaged radiation source, by P. W. Howe, J. E. Rainey, and H. F. Soule. University of California. Lawrence Radiation Laboratory, Berkeley, Calif. June 60. Contract W-7405-eng-48. 11p. Order from OTS. 50 cents. UCRL-9291

Instruments

Logarithmic spiral light pipe for scintillators, by W. C. Kaiser, A. J. MacKay and W. W. Managan. Argonne National Laboratory, Argonne, Ill. Aug 60. Contract W-31-109-eng-38. 11p. Order from OTS. 50 cents. ANL-6196

A precision current integrator, by I. T. Myers and G. T. Orton. Hanford Atomic Products Operation, Richland, Wash. Feb 60. Contract AT(45-1)-1350. 11p. Order from OTS. 50 cents. . HW-65802

Revised neutron flux, spectrum, and tissue dose measurements at the Godiva II critical assembly, by J. A. Sayeg. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Sep 60. Contract W-7405-ENG-36. 23p. Order from OTS. 50 cents. LA-2432

A multichannel digital recording system, by R. W. Truitt. Atomics International. A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 60. Contract AT(11-1)-GEN-8. 21p. Order from OTS. 50 cents. NAA-SR-5354

Instrumentation and controls division semiannual progress report for period ending July 31, 1953, by C. J. Borkowski. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 54. Decl. May 10. 1960. Contract W-74-5-eng-26. 33p. Order from OTS. 40 cents. ORNL-1694

A method for calculating the cutting force component parallel to the plane of motion of the cutter, by C. I. Millard. Sandia Corporation, Albuquerque, N. Mex. Aug 60. 6p. Order from OTS. 50 cents. SCDR-204-60

An investigation of long-term stability of zener voltage references, by R. P. Baker and J. Nagy, Jr. Sandia Corporation, Albuquerque, N. Mex. June 60. 21p. Order from OTS. 75 cents. SCR-194

Inertial power supplies for ballistic missile re-entry vehicles, by R. J. Martin. Sandia Corporation, Albuquerque, N. Mex. July 60. 15p. Order from OTS. 50 cents. SCR-219

A method for ascertaining the effect of large targets present in terrain return signals, by D. M. Gragg. Sandia Corporation, Albuquerque, N. Mex. Sep 54. 12p. Order from OTS. 50 cents. SCTM-187-54(54)

Pulse response of terrain return program receivers, by F. J. Janza, R. A. Hessemer, Jr., and C. S. Williams, Jr. Sandia Corporation, Albuquerque, N. Mex. Sep 54. 14p. Order from OTS. 50 cents. SCTM-208-54(54)

Instrumentation application of carrier-erase magnetic-tape recording, by R. S. Reynolds. Sandia Corporation, Albu querque, N. Mex. Aug 60. 10p. Order from OTS. 50 cents. SCTM-237-60(52)

Low noise amplifiers for use with solid state detectors, by J. L. Blankenship and others. Oak Ridge National Laboratory, Union Carbide Nuclear Company, Oak Ridge, Tenn. and Office of Technical Information Extension, Oak Ridge, Tenn. Aug 60. 41p. Order from OTS. 50 cents. TID-6119

Metallurgy and Ceramics

The response of concrete shear keys to dynamic loading, by E. G. Nawy and J. M. Shah. Massachusetts Institute of Technology, Cambridge, Mass. Jan 59. Contract AT(29-2)-616. 65p. Order from LC. Mi $3.90, ph $10.80. AECU-4562

Behavior of bond under dynamic loading, by A. A. Lippins. Massachusetts Institute of Technology, Department of Civil and Sanitary Engineering, Cambridge, Mass. Sep 59. Contract AT(29-2)-616. 101p. Order from LC. Mi $5.70, Mi $16.80. AECU-4563

Thorium bismuthide--ultrasonic control of crystal size. Aeroprojects, Inc., West Chester, Pa. Mar 59. 12p. Order from LC. Mi $2.40, ph $3.30. AECU-4605

Review of the intermetallic compounds of plutonium, by F. H. Ellinger. Los Alamos Scientific Lab., Los Alamos, N. Mex. 1959. 49p. Order from LC. Mi $3.30, ph $7.80. AECU-4629

A survey of non-fuel-bearing materials for the marine gas-cooled reactor, by J. C. Bokros, L. Dijkstra, and U. Merten. General Atomic Div., General Dynamics Corporation, San Diego, Calif. May 58. Contract AT(04-3)-187. 52p. Order from LC. Mi $3.60, ph $9.30. AECU-4692

Results of experiments made with U.S.B.M. electrocerium, by W. N. Miner. Los Alamos Scientific Laboratory, N. Mex. Feb 59. 8p. Order from LC. Mi $1.80, ph $1.80. AECU-4669

Electron diffraction study of the removal and formation in vacuo of oxide films on uranium and plutonium, by J. T. Waber, C. Olsen, and D. D. Whyte. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. 1959. 29p. Contract W-7405-eng-36. 29p. Order from LC. Mi $2.70, ph $4.80. AECU-4742

The manufacture of centrifugally cast alloy fuel slugs (Mark-II fuel loading for EBR-I), by F. L. Yaggee. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 37p. Order from OTS. $1.00. ANL-5724

Examination of irradiated EBWR Core-I fuel elements, by C. F. Reinke and R. Carlander. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 31p. Order from OTS. 75 cents. ANL-6091

The adiabatic elastic moduli of single-crystal alpha uranium at 25°C, by E. S. Fisher. Argonne National Laboratory, Argonne, Ill. June 60. Contract W-31-109-eng-38. 91p. Order from OTS. $2.00. ANL-6096

A study of irradiation effects in type "A" nickel and type 347 stainless steel tensile specimens, by S. H. Paine, W. F. Murphy and D. W. Hackett. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 43p. Order from OTS. $1.00. ANL-6102

Self-diffusion in Beta uranium, by S. J. Rothman, J. Gray, Jr., J. P. Hughes, and A. L. Harkness. Argonne National Laboratory, Argonne, Ill. July 60. Contract W-31-109-eng-38. 20p. Order from OTS. 50 cents. ANL-6126

Dispersed phase strengthening of corrosion-resistant aluminum, from Armour Research Foundation of Illinois Institute of Technology. Argonne National Laboratory, Argonne, Ill. May 60. Contract W-31-109-eng-38. 42p. Order from OTS. $1.25. ANL-6188

Fundamental alloy development studies. Quarterly progress report no. 5 for November 1, 1956 to January 31, 1957, by C. E. Lundin and D. T. Klodt. University of Denver, Denver Research Institute, Denver, Colo. Feb 57. Decl. with deletions November 4, 1959. 39p. Order from LC. Mi $3.00, ph $6.30. APEX-300(Del.)

Fundamental alloy development studies. Quarterly progress report no. 7 for May 1, 1957 to July 31, 1957, by C. E. Lundin and D. T. Klodt. University of Denver, Denver Research Institite, Denver, Colo. Aug 57. Decl. with detetions November 4, 1959. 28p. Order from LC. Mi $2.70, ph $4.80. APEX-334(Del.)

Fundamental alloy development studies. Quarterly progress report no. 9 for November 1, 1957 to January 31, 1958, by C. E. Lundin, D. T. Klodt, R. D. Seibel, and M. M. Mote. University of Denver. Denver Research Institute, Denver, Colo. Feb 58. Decl. with deletions November 4, 1959. 65p. Order from LC. Mi $3.90, ph $10.80. APEX-360(Del.)

Component development. Progress report no. 4, by J. D. Roach. Titanium Alloy Manufacturers. Division of National Lead Company, Niagara Falls, N. Y. May 58. Decl. with deletions November 4, 1959, Contracts AT(11-1)-171 and

AF 33(600)-38062. 18p. Order from LC. Mi $2.40, ph $3.30. APEX-423(Del.)

Fundamental alloy development studies. Quarterly progress report no. 4 for May 1, 1958 to July 31, 1958, by C. E. Lundin, D. T. Klodt, R. D. Seibel, and M. W. Mote. University of Denver, Denver Research Institute, Denver, Colo. Aug 58. Decl. with deletions November 4, 1959. Contracts AT(11-1)-171 and AF 33(600)-38062. 94p. Order from LC. Mi $5.40, ph $15.30. APEX-424(Del.)

Fundamental alloy development studies. Quarterly progress report no. 10 for February 1, 1958 to April 30, 1958, by C. E. Lundin, D. T. Klodt, R. D. Seibel, and M. M. Mote. University of Denver. Denver Research Institute, Denver, Colo. May 58. Decl. with deletions November 4, 1959. Contracts AT(11-1)-171 and AF 33(600)-38062. 52p. Order from LC. Mi $3.60, ph $9.30. APEX-449(Del.)

Evaluation of rolling contacts in the range of 550°F to 1000°F, by S. F. Murray and P. Lewis. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Feb 58. Contracts AT(11-1)-171 and AF 33(600)-38062. 90p. Order from OTS. $2.00. APEX-560

Structural analysis of molybdenum-base alloys by use of a material constant and the least-square error, by A. L. Ross and B. R. Thompson. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Feb 57. Contracts AT(11-1)-171 and AF 33(600)-38062. 24p. Order from OTS. 50 cents. APEX-568

Investigation of solid film lubricants and sliding contacts at temperatures above 1000°F, by M. B. Peterson. General Electric Co., Aircraft Nuclear Propulsion Department, Cincinnati, Ohio. Aug 60. Contracts AT(11-1)-171 and AF 33(600)-38062. 63p. Order from OTS. $1.50. APEX-569

Evaluation of oxidation-resistant ceramics for high-temperature reactor elements, by C. G. Harman, E. F. Ferrell, H. E. Wagner, and J. F. Quirk. Battelle Memorial Institute, Columbus, Ohio. Dec 52. Decl. December 15, 1959. Contract W-7405-eng-92. 39p. Order from LC. Mi $3.00, ph $6.30. BMI-787

The effects of chemical impurities on the quality rolled uranium rod, by H. A. Saller, J. R. Keeler, and L. J. Cuddy. Battelle Memorial Institute, Columbus, Ohio. Oct 54. Decl. December 15, 1959. Contract W-7405-eng-92. 18p. Order from LC. Mi $2.40, ph $3.30. BMI-952

Progress relating to civilian applications during December, 1956, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Jan 57. Decl. August 15, 1960. Contract W-7405-eng-92. 55p. Order from OTS. 55 cents. BMI-1152

Progress relating to civilian applications during January, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Feb 57. Decl. August 15, 1960. Contract W-7405-eng-92. 75p. Order from OTS. 55 cents. BMI-1161

Process relating to civilian applications during February, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Mar 57. Decl. August 16, 1960. Contract W-7405-eng-92. 71p. Order from OTS. 55 cents. BMI-1173

Progress relating to civilian applications during March, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Apr 57. Decl. August 15, 1960. Contract W-7405-eng-92. 80p. Order from OTS. 55 cents. BMI-1176

Progress relating to civilian applications during June, 1957, by R. W. Dayton and C. R. Tiptons, Jr. Battelle Memorial Institute, Columbus, Ohio. July 57. Decl. August 15, 1960. Contract W-7405-eng-92. 58p. Order from OTS. 50 cents. BMI-1201

Progress relating to civilian applications during July, 1957, by R. W. Dayton and C. R. Tipton, Jr. Battelle Memorial Institute, Columbus, Ohio. Aug 57. Decl. August 15, 1960. Contract W-7405-eng-92. 69p. Order from OTS. 50 cents. BMI-1213

Progress on ceramic coated fuel particles at Battelle. Presented at the AEC Information Meeting held at Battelle Memorial Institute on July 12, 1960, by W. S. Diethorn and others. Battelle Memorial Institute, Columbus, Ohio. Sep 60. Contract W-7405-eng-92. 31p. Order from OTS. 75 cents. BMI-1468

Creep and corrosion properties of Zircaloy-2 in steam at 750 F, by E. J. Jablonowski and F. R. Shober. Battelle Memorial Institute, Columbus, Ohio. Aug 60. Contract W-7405-eng-92. 20p. Order from OTS. 50 cents. BMI-1457

Monthly progress report, by R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Aug 55. Decl. August 12, 1960. Contract AT(30-1)-1405. 14p. Order from OTS. 30 cents. BRB-13

Extrusion of uranium for Hanford cored slug program - II, by G. T. Murray and R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Nov 55. Decl. August 15, 1960. Contract AT (30-1)-1405. 47p. Order from OTS. 45 cents. BRB-16

Extrusion of uranium for Hanford cored slug program--III and IV, by G. T. Murray and R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Dec 55. Decl. August 12, 1960. Contract AT(30-1)-1405. 33p. Order from OTS. 40 cents. BRB-17

Extrusion of uranium for Hanford cored slug program - VII, by G. T. Murray and R. M. Treco. Brideeport Brass Company, Bridgeport, Conn. Feb 56. Decl. August 12, 1960. Contract AT (30-1)-1405. 28p. Order from OTS. 35 cents. BRB-20

Monthly progress report for January 1956, by R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. Feb 56. Decl. May 17, 1960. Contract AT(30-1)-1405. 33p. Order from OTS. 40 cents. BRB-29

Monthly progress report for April - May 1956, by R. M. Treco. Bridgeport Brass Company, Bridgeport, Conn. June 56. Decl. August 15, 1960. Contract AT(30-1)-1405. 39p. Order from OTS. 40 cents. BRB-31

A Nonbond detector for hollow slugs, by J. D. Ross and R. W. Leep. E. I. du Pont de Nemours & Co., Explosives Department, Atomic Energy Division, Technical Division, Savannah River Laboratory, Aiken, S. C. Oct 56. Decl. August 12, 1960. Contract AT(07-2)-1. 12p. Order from OTS. 25 cents. DP-164

An evaluation of nickel-copper alloys for use as graphite-cladding materials at elevated temperatures, by D. G. Guggisberg, and J. C. Bokros. General Dynamics Corporation, San Diego, Calif. Apr 60. Contract AT(04-3)-187. 19p. Order from OTS. 75 cents. GA-1281

Carbon steel for the Hanford new production reactor, by W. D. Gilbert and others. Hanford Atomic Products Operation, Richland, Wash. Nov 58. Contract W-31-109-Eng-52. 17p. Order from OTS. 50 cents. HW-58299REV

Casting aluminum-plutonium alloys, by C. H. Bloomster. Hanford Atomic Products Operation, Richland, Wash. Mar 60. Contract AT(45-1)-1350. 19p. Order from OTS. 75 cents. HW-63166

Weld alloying improvement with square type current waves on alternating-current tungsten-arc inert-gas-shielded welding, by T. B. Correy. Hanford Atomic Products Operation, Richland, Wash. May 60. Contract AT(45-1)-1350. 71p. Order from OTS. $2.00. HW-64252

Ultrasonic inspection of PRTR fuel element cladding, by P. L. Farnsworth. Hanford Atomic Products Operation, Richland, Wash. Apr 60. Contract AT(45-1)-1350. 19p. Order from OTS. 75 cents. HW-64562

Progress report on fuel element development and associated projects, by W. C. Francis and S. E. Craig. Phillips Petroleum Company, Idaho Operations Office, Idaho Falls, Idaho. Aug 60. Contract AT(10-1)-205. 151p. Order from OTS. $2.25. IDO-16574

Uranium glasses: II. Uranium silicate glasses, by C. D. Wirkus and D. R. Wilder. Iowa State University of Science and Technology, Ames Laboratory, Ames, Iowa. June 60. Contract W-7405-eng-82. 30p. Order from OTS. 75 cents. IS-158

High temperature corrison of some metals and ceramics in fluorinating atmospheres, by C. F. Hale and others. Union Carbide Nuclear Company pany, Division of Union Carbide Corporation, Oak Ridge Gaseous Diffusion Plant, Oak Ridge, Tenn. Sep 60. Contract W-7405-eng-26. 63p. Order from OTS. $1.75. K-1459

Aluminum canning of nickel-plated, Hanford four-inch uranium fuel slugs by hot-pressing, by H. T. Sumsion, C. J. Beck, and L. S. DeLuca. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. May 55. Decl. August 25, 1960. Contract W-31-109-Eng-52. 42p. Order from OTS. 35 cents. KAPL-1335

The application of cold-powder extrusion and sintering to the fabrication of stainless steel- UO_2 fuel elements, by H. G. Sowman and G. L. Ploetz. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. June 55. Decl. August 19, 1960. Contract W-31-109-Eng-52. 15p. Order from OTS. 25 cents. KAPL-1345

Zirconium coating of uranium by iodide decomposition, by W. L. Robb, and A. C. Schafer. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Dec 55. Decl. August 25, 1960 . Contract W-31-109-Eng-52. 74p. Order from OTS. 55 cents. KAPL-1424

Burnable poison additives to uranium dioxide, by G. L. Ploetz and H. G. Sowman. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Nov 55. Decl. August 20, 1960. Contract W-31-109-Eng-52. 18p. Order from OTS. 30 cents. KAPL-1447

Fabrication of uranium-rich, uranium-zirconium dispersion fuels by hydrostatic hot pressing, by R. N. Honeyman. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Nov 56. Decl. August 25, 1960. Contract W-31-109-Eng-92. 35p. Order from OTS. 40 cents. KAPL-1670

Cyclic strain fatigue of inconel at 75 to 600°F, by A. E. Dinerman. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Aug 60. Contract W-31-109-Ebg-52. 13p. Order from OTS. 50 cents. KAPL-2084

Welding type 410 stainless steel to inconel, by J. D. Casey. General Electric Company, Knolls Atomic Power Laboratory, Schenectady, N. Y. Mar 60. Contract W-31-109-Eng-52. 8p. Order from OTS. 50 cents. KAPL-2087

Production of molybdenum-uranium and zirconium-uranium alloys, by C. W. Loveland and J. E. Owen. Union Carbide Nuclear Company, Division of Union Carbide Corporation, Paducah, Ky. Aug 60. Contract W-7405-eng-26. 26p. Order from OTS. 50 cents. KY-348

Process development and fabrication of Th-7.6 WT % U fuel elements for the second core loading of the sodium reactor experiment, by J. A. Stanley and M. H. Binstock. Atomics International A Division of North American Aviation, Inc., Canoga Park, Calif. Sep 60. Contract AT(11-1)-GEN-8. 30p. 50 cents. NAA-SR-5144

Briquetted uranium tetrafluoride-magnesium blend for batch reduction charges, by G. E. Wuller, Jr. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Dec 56. Decl. August 25, 1960. Contract AT(30-1)-1156. 21p. Order from OTS. 35 cents. NLCO-672

Papers presented at the X-ray preferred orientation meeting held at National Lead Company of Ohio, November 9 and 10, 1959, by P. R. Morris and others. National Lead Company of Ohio, Cincinnati, Ohio. July 60. Contract AT(30-1)-1156. 64p. Order from OTS. $1.50. NLCO-804

Grain refinement of cast uranium by heat treatment, by G. W. Powell, J. L. Klein, and D. Krashes. Nuclear Metals, Inc. Cambridge, Mass. July 57. Decl. August 25, 1960. Contract AT(30-1)-1565. 32p. Order from OTS. 65 cents. NMI-1180

Thermal coefficient of expansion of uranium by means of bonded wire resistance strain gages, by M. R. Goodman. Oak Ridge National Laboratory, Oak Ridge, Tenn. Dec 49. Decl. May 10, 1960. Contract W-7405-eng-26. 55p. Order from OTS. 50 cents. ORNL-518

Alloying of zirconium-containing fuels with zinc and magnesium, by R. G. Wymer and J. F. Land. Oak Ridge National Laboratory, Oak Ridge, Tenn. May 57. Decl. May 18, 1960. Contract W-7405-eng-26. 11p. Order from OTS. 30 cents. ORNL-2184

The stability of europium oxide in silicon-bearing stainless steel, by C. F. Leitten, Jr. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd. Contract W-7405-eng-26. 83p. Order from OTS. $2.25. ORNL-2946

Development of a compartmented type flat plate fuel element, by W. G. Lidman, R. L. Harmon, and H. S. Kalish. Sylvania-Corning Nuclear Corp., Bayside, Long Island, N. Y. Apr 57. Decl. August 18, 60. Contract AT-30-1-GEN-366. 31p. Order from OTS. 35 cents. SCNC-246

The control of grain size in sintered uranium compacts, by J. L. Zambrow and H. H. Hausner. Sylvania Electric Products, Inc., Bayside, N. Y. Aug 51. Decl. July 13, 1960. Contract AT-30-1-Gen-366. 24p. Order from OTS. 35 cents. SEP-72

Preferred orientation in zirconium alloy wire fuel elements, by R. W. Campbell and W. P. Chernock. Technical Information Service, Oak Ridge, Tenn. [nd. Decl. July 14, 1960. 38p. Order from OTS. 35 cents. SEP-111

The canning of UO_3 powder for sampling, by H. H. Hausner, J. L. Zambrow and S. Storchheim. Sylvania Electric Porducts Inc., Metallurgical Laboratory, Bayside, New York. Mov 51. Decl. July 13, 1960. Contract AT-30-1-Gen-366. 19p. Order from OTS. 30 cents. SEP-79

Zirconium: A bibliography of confidential U. S. Atomic Energy Commission Reports Available through the Civilian Application Program, by Technical Information Service Extension, Oak Ridge, Tenn. July 56. Decl. May 24, 1960. 62p. Order from OTS. 50 cents. TID-3204

Proceedings of the metallurgy information meeting held at Oak Ridge, April 11-13, 1955, by L. K. Jetter and others. Atomic Energy Technical Information Service Extension, Oak Ridge, Tenn. 1955. Decl. December 1, 1959. 533p. in Pt. 1, and 423p. in Pt. II. Order from OTS. Total price $9.00. TID-7502 (Pt. I & II) (Del. 2)

AEC-Euratom conference on aqueous corrosion of reactor materials held in Brussels, Belgium on October 14-17, 1959, by R. R. Nash and others. Office of Technical Information Extension, Oak Ridge, Tenn. July 60. 465p. Order from OTS. $4.75. TID-7587

Summary technical report for the period October 1, 1954 to December 31, 1954, by J. W. Simmons and others. National Lead Company of Ohio, Technical Division, Cincinnati, Ohio. Jan 55. Decl. August 18, 1960. Contract AT(30-1)-1156. 220p. Order from OTS. $1.10. TID-10111

Metallurgical progress report no. 7 for the period of Apr 1, 1960 to June 30, 1960, by M. L. Wright and others. U. S. Department of the Interior, Bureau of Mines, Albany Metallurgy Research Center, Albany, Ore. June 60. Contract AT(11-1)-599. 47p. Order from OTS. $1.50. USBM-U-745

Outline of alternate control material information obtained at Bettis Plant. Westinghouse Electric Corporation, Bettis Plant, Pittsburgh, Pa. July 56. Decl. May 23, 1960. 102p. Order from OTS. 60 cents. WAPD-SFR-Fs-173

Nuclear Explosions—Peaceful Applications

Proceedings of the conference on scientific applications of nuclear explosions held July 6-8, 1959, Los Alamos, New Mexico, by G. A. Cowan. The University of California. Los Alamos Scientific Laboratory, Los Alamos, N. Mex. Sep 60. Contract W-7405-ENG-36. 75p. Order from OTS. $1.75. LAMS-2443

Oak Ridge National Laboratory sampler for the tamalpais underground nuclear detonation experiment, by J. W. Landry. Oak Ridge National Laboratory, Oak Ridge, Tenn. [nd.] Contract W-7405-eng-26. 19p. Order from OTS. 50 cents. ORNL-2881

Geologic investigations in support of project chariot in the vicinity of Cape Thompson, northwestern Alaska--Preliminary report, by R. Kachadoorian and others. Geological Survey, Washington, D. C. Jan 60. 94p. Order from OTS. $2.00. TEI-753

Some effects of underground nuclear explosions on tuff, by V. R. Wilmarth. Geological Survey, Washington, D. C. Dec 59. 34p. Order from OTS. 75 cents. TEI-756

Nuclear explosives and mining costs, by F. L. Smith and T. R. Young. University of California, Lawrence Radiation Laboratory, Livermore, Calif. July 60. Contract W-7405-eng-48. 37p. Order from OTS. $1.00. UCRL-5928

Postshot disturbances and surface motions--Operation Hardtack-II, by L. M. Swift and others. Stanford Research Institute, Menlo Park, Calif. Feb 60. 28p. Order from OTS. 75 cents. WT-1740

Particle Accelerators and High-Voltage Machines

Particle accelerator Division, summary report for May 1959 through March 1960, by A. V. Crewe, and others. Argonne National Laboratory, Argonne, Ill. 1960. Contract W-31-109-eng-38. 56p. Order from OTS. $1.25. ANL-6152

Integral scaling magnetic field using distributed windings, by S. C. Snowdon. Midwestern Universities Research Association, Madison, Wis. Aug 60. Contract AT(11-1)-384. 19p. Order from OTS. 50 cents. MURA-583

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Radioactive Waste

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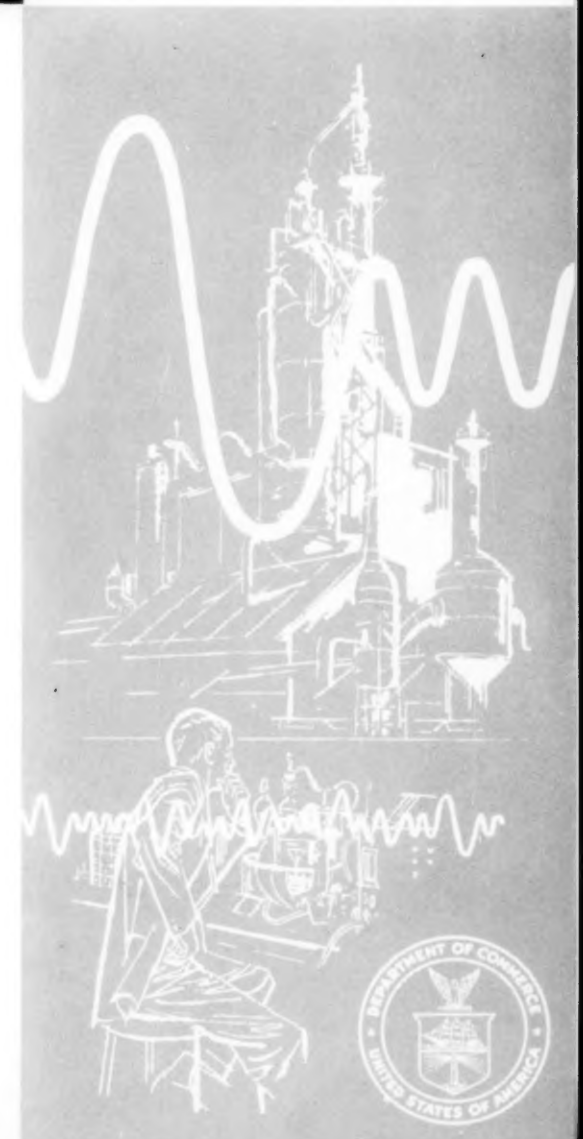

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		148 436
		148 894
	529	149 509
	604	146 457
		147 797
		147 798
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		148 740
	605	148 162
	651	149 487
	701	149 502
	709	149 943
	743	147 895
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	487	146 621
	584	146 630
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	685	150 021
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	419	148 071
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		147 944
	562	149 877
	639	149 505
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		146 867
	128	146 864
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		147 550
	165	146 862
	207	146 757
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	310	147 626
	334	146 458
	383	146 345
		148 265
	387	146 302
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	390	161 860
	485	148 228
	487	148 029
	495	148 445
	686	149 906
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	537	146 459
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	312	146 279
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		148 074
	283	148 115
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		148 463
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		146 332
		147 600
	348	147 728
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Cognitive Operations Lab., Bethany Coll., W. Va.	119	147 078
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College of the Holy Cross, Worcester, Mass.	262	147 854
Collins Radio Co., Burbank, Calif.	711	139 368
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Cologne U. (Germany)	14	146 198
Colorado U., Boulder	5	145 846
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Columbia Radiation Lab., New York	711	147 633
Columbia U., New York	183	146 429
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Computation Lab., Harvard U., Cambridge, Mass.	68	145 870
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Illinois U., Urbana	10	146 191
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	477	148 874
	480	161 836
	497	148 772
	531	148 899
	622	149 278
	641	148 971
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Industrial Lab., Mare Island Naval Shipyard, Vallejo, Calif.	261	146 036
Industrial Test Lab., Philadelphia Naval Shipyard, Pa.	75	145 834
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Ingersoll Kalamozoo Div., Borg-Warner Corp., Mich.	481	148 461
Inland Testing Labs., Morton Grove, Ill.	58	146 574
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Institut d'Optique, Paris (France)	462	147 252
Institut Pasteur, Paris (France)	386	146 955
Institute for Advanced Study, Princeton, N. J.	65	146 213
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Institute for Applied Experimental Psychology Tufts U., Medford, Mass.	6	161 125
Institute for Fluid Dynamics and Applied Mathematics, U. of Maryland, College Park	184	146 422
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	502	148 211
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Institute for the Study of Metals, U. of Chicago, Ill.	20	145 836
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Institute of Field Physics, U. of North Carolina, Chapel Hill	347	146 949
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Institute of Flight Structures, Columbia U., New York	30	145 800
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Institute of Geophysics, U. of California, Los Angeles	700	149 535
Institute of Mathematical Sciences, New York U., New York	65	145 743
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Institute of Metals and Explosives Research, U. of Utah, Salt Lake City	729	150 167
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Institute of Personality Assessment and Research, U. of California, Berkeley	7	146 143
Institute of Psychiatry, Maudsley Hospital, London (Gt. Brit.)	12	146 204
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Institute of Research, Lehigh U., Bethlehem, Pa.	221	145 944
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Institute of Rubber Research, U. of Akron, Ohio	63	146 230
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Institute of Statistics, U. of North Carolina, Chapel Hill	745	148 239
Institute of Tech., U. of Minnesota, Minneapolis	90	146 028
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Institute of Theoretical Physics, Stanford U., Calif.	205	146 875
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Instituto de Edafologia y Fisiologiya Vegetal, Madrid, (Spain)	698	147 622
Instituto de Quimica Fisica (Spain)	690	147 614
Instituto Nacional de Tecnica Aeronautica Esteban Terradas (Spain)	178	147 142
Instrumentation Lab., Mass. Inst. of Tech., Cambridge	203	147 266
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Interaction Lab., Yale U., New Haven, Conn.	254	138 123
International Business Machines Corp., Kingston, N. Y.	716	150 807
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International Business Machines Corp., New York	581	147 345
International Geophysical Year	700	147 873
International Inst. of Meteorology U. of Stockholm (Sweden)	694	147 874
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International Resistance Co., Philadelphia, Pa.	39	161 688
International Telemeter Corp., Los Angeles, Calif.	462	146 723
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Israel Inst. of Tech., Haifa	184	146 424
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Istituto di Chimica Generale dell' Universita, Palermo (Italy)	395	148 360
Istituto do Fisica Superiore, Universita di Pavia (Italy)	213	146 834
Istituto di Metallurgia e Metallografia, Universita degli Studi di Roma (Italy)	133	145 954
Istituto Elettrotecnico Nazionale "Galileo Ferraris" (Italy)	76	145 861
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I.T.E. Circuit Breaker Co., Philadelphia, Pa.	425	147 953
Itek Corp., Waltham, Mass.	340	147 851
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ITT Labs., Nutley, N. J.	425	146 597
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J. G. Engineering Research Associates, Baltimore, Md.	621	145 249
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Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena	20	145 888
	56	146 856
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Johns Hopkins U., Baltimore, Md.	65	145 774
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Johns Hopkins U. School of Engineering, Baltimore, Md.	218	146 428
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Johnson Research Foundation, U. of Pennsylvania, Philadelphia	87	145 812
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Kaman Aircraft Corp., Bloomfield, Conn.	30	146 103
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Karolinska Institutet, Stockholm (Sweden)	14	146 205
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Kellett Aircraft Corp., Willow Grove, Pa.	557	149 817
Kennametal, Inc., Latrobe, Pa.	173	146 477
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Keystone Electronics Co., Philadelphia, Pa.	154	137 445
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Laboratoire de Physique Theorique et Hautes Energies, Faculte des Sciences, Orsay (France)	757	149 589
Laboratoire Mediterraneen de Recherches Thermodynamiques (France)	194	146 134
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Laboratori di Elettrochimica, Chimica Fisica e Metallurgia del Politecnico di Milano (Italy)	266	161 801
Laboratorio di Meccanica Applicata del Politecnico di Torino (Italy)	73	138 056
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Laboratory for Insulation Research, Mass. Inst. of Tech., Cambridge.	83	145 849
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Laboratory for Molecular Studies, U. of Chicago, Ill.	778	148 996
Laboratory for Nuclear Science, Mass. Inst. of Tech., Cambridge.	249	147 714
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Laboratory of Astrophysics and Physical Meteorology, Johns Hopkins U., Baltimore, Md.	637	149 162
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Laboratory of Aviation Psychology, Ohio State U. Research Foundation, Columbus	8	161 550
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Laboratory of Climatology, Centerton, N. J.	136	137 849
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Laboratory of Social Relations, Harvard U., Cambridge, Mass.	380	146 683
Laboratory of Statistical Research, U. of Washington, Seattle	185	147 075
Lamont Geological Observatory, Palisades, N. Y.	384	148 598
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Land-Air, Inc., Holloman, N. Mex.	154	146 980
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Land Locomotion Lab., Ordnance Tank-Automotive Command, Center Line, Mich.	175	146 774
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Lockheed Aircraft Corp., Marietta, Ga.	331	148 381
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	320	148 078
	322	147 667
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Louvain U. (Belgium)	396	146 640
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Lovelace Foundation, Albuquerque, N. Mex.	384	146 629
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McGraw-Hill Book Co., New York	579	161 894
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Mallinckrodt Chemical Lab., Harvard U., Cambridge, Mass.	87	145 746
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Mallory, P. R., and Co., Inc., Indianapolis, Ind.	40	161 659
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Manchester Coll. of Science and Technology (Gt. Brit.)	179	146 833
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Manufacturing Labs., Inc., Cambridge, Mass.	497	148 794
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Materials Advisory Board, National Research Council, Washington, D. C.	622	150 077-2
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	608	148 799
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		146 453
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Minnesota U., Minneapolis	9	146 353
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	124	137 960
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	186	147 122
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	543	150 295
	692	148 070
Westinghouse Electric Corp., Baltimore, Md.	165	161 762
	582	147 130
		147 949
		147 950
Westinghouse Electric Corp., Bloomfield, N. J.	758	161 978
Westinghouse Electric Corp., East Pittsburgh, Pa.	558	149 613
	559	149 612
		149 614
Westinghouse Electric Corp., Elmira, N. Y.	583	161 944
Westinghouse Electric Corp., Lester, Pa.	296	161 782
Westinghouse Research Labs., Pittsburgh, Pa.	146	138 058
	204	161 718
	345	147 303
	400	148 404
	433	149 289
	621	161 936
	788	149 572
		149 812
Wharton School of Finance and Commerce, U. of Pennsylvania, Philadelphia	274	148 143
	350	148 145
White Sands Missile Range, N. Mex.	51	146 697
Wiancko Engineering Co., Pasadena, Calif.	593	150 156
Wichita U., Kansas	559	149 483
		149 484
Wigley, C. (Gt. Brit.)	324	146 294
Wiley Electronics Co., Phoenix, Ariz.	165	147 054
Willow Run Labs., U. of Michigan, Ann Arbor	9	145 830
		145 831
	12	145 785
	22	145 973
	32	146 870
	47	145 786
	48	145 991
		145 997
	68	145 998
	80	145 892
	85	146 254
	92	146 869
	97	145 992
	122	147 001
	188	146 244
	213	146 828
	214	147 364
	215	146 829
	217	147 304
	339	145 972
	461	148 524
	602	149 455
	638	147 275
	726	149 456
	772	149 939
		149 940
	788	150 183
Winzen Research, Inc., Minneapolis, Minn.	144	146 511
Wisconsin U., Madison	68	146 212
	128	146 830
	296	147 922
		147 923
	297	147 924
		147 925
		147 926
		147 927
		147 928
		147 929
	298	147 930
	317	138 139
		147 867
		147 870
	461	148 875
	484	147 443
	673	149 860
	696	148 252
	697	148 251
		150 049
Wisconsin U. School of Pharmacy, Madison	128	146 756
Wolf Research and Development Corp.	408	147 444
Woods Hole Oceanographic Institution, Mass.	27	146 245
	349	148 175
	546	148 892
	551	148 126
	650	146 570
	699	146 999
Wright Air Development Div. Wright-Patterson AFB, Ohio	207	161 308
	419	148 071
X-Ray and Crystal Analysis Lab., Pennsylvania State U., University Park	351	147 860
	501	146 579
Yale U., New Haven, Conn.	22	146 175
	256	146 298
	264	147 858
	393	161 849
	463	148 568
	535	149 479
	609	146 450
	681	148 962
	779	147 893
Yale U. Observatory, New Haven, Conn.	583	149 177
Yerkes Observatory, Williams Bay, Wis.	371	146 354
Zator Co., Cambridge, Mass.	799	147 541
Zemanek, Heinz, Vienna (Austria)	612	149 452

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